

CENTRAL AND SOUTHERN FLORIDA PROJECT: COM-  
PREHENSIVE EVERGLADES RESTORATION PLAN  
C-111 SPREADER CANAL WESTERN PROJECT

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COMMUNICATION

FROM

THE ASSISTANT SECRETARY OF THE ARMY,  
CIVIL WORKS, THE DEPARTMENT OF DE-  
FENSE

TRANSMITTING

A REPORT ON THE AUTHORIZATION OF THE C-111 SPREADER  
CANAL WESTERN PROJECT

VOLUME 1 OF 5



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DEPARTMENT OF THE ARMY  
OFFICE OF THE ASSISTANT SECRETARY  
CIVIL WORKS  
108 ARMY PENTAGON  
WASHINGTON DC 20310-0108

JUL 19 2012

Honorable John A. Boehner  
Speaker of the House  
of Representatives  
U.S. Capitol Building, Room H-232  
Washington, D.C. 20515-0001

Dear Mr. Speaker:

In accordance with Section 601(d) of the Water Resources Development Act (WRDA) of 2000, the Secretary of the Army supports the authorization and construction of the C-111 Spreader Canal Western project in Miami-Dade County, Florida, for the purposes of ecosystem restoration and recreation, and the deauthorization of the C-111 Spreader Canal project that was authorized by Section 601(b)(2)(C)(x) of the WRDA of 2000. The proposal is described in the report of the Chief of Engineers, dated January 30, 2012, which includes other pertinent documents. The views of the South Florida Water Management District (SFWMD), the State of Florida, the Department of the Interior, the Environmental Protection Agency, and the Federal Emergency Management Agency are set forth in the enclosed report. The Secretary of the Army plans to implement the project at the appropriate time, considering National priorities and the availability of funds.

The project would be a major step in the modification of the Central and Southern Florida (C&SF) project to help restore, preserve, and protect the South Florida ecosystem, while providing for other water-related needs of the region. The project was identified as a feature of the Comprehensive Everglades Restoration Plan (CERP), which was approved by Section 601(b)(1) of the WRDA of 2000 as a framework for modifying the C&SF project. Section 601(b)(2)(C)(x) authorized a C-111 Spreader Canal project as a CERP feature at a cost of \$94,035,000, subject to the Secretary of the Army's review and approval of a Project Implementation Report. That project was not constructed and would not meet the needs of the CERP.

The recommended project would significantly contribute to three CERP goals and objectives – increase the spatial extent of natural areas, improve habitat and functional quality, and improve native plant and animal species abundance and diversity. It would also contribute to the socioeconomic objective of providing incidental recreation opportunities. Cost effectiveness and incremental cost analysis techniques were used to ensure that an appropriate ecosystem restoration plan was recommended. The report identifies the recommended ecosystem restoration improvements as the National Ecosystem Restoration (NER) Plan.

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The recommended project would improve the ecological functions of Taylor Slough and Florida Bay in the Everglades National Park (ENP) by retaining water that is currently lost eastward to the Atlantic Ocean, and improve the ecological functions of the Southern Glades and Model Lands wetlands east of the ENP. The plan would also reduce uncertainties for a future investigation of ecosystem restoration in the area east of the ENP. The ecosystem restoration features include two above-ground detention areas that together extend about six miles along the eastern boundary of the ENP, and appurtenant levees and water control features (pumps). The detention areas would create a hydraulic ridge to reduce water losses across the ENP boundary. Features to restore the Southern Glades and Model Lands wetlands include operational changes at existing water control structures, a new water control structure in the lower C-111 Canal, and plugs in other existing canals.

The plan would produce an average annual increase of about 8,271 average annual habitat units, which constitutes a significant benefit to fish and wildlife habitat. This would include habitat for twenty Federally-listed threatened or endangered species and, in particular, designated critical habitat for the American crocodile, Everglade snail kite, West Indian manatee, Elkhorn coral, Staghorn coral, and the Cape Sable Seaside Sparrow.

Based on October 2011 price levels, the estimated Total Project First Cost is \$165,098,000, which includes \$164,832,000 for ecosystem restoration. In accordance with Section 601(e) of the WRDA of 2000, the estimated Federal and non-Federal costs for ecosystem restoration would be \$82,416,000 each. Based on a discount rate of 4.0 percent and a 40-year period of analysis, the average annual cost for restoration is estimated at \$10,229,000, which includes the cost of operation, maintenance, repair, rehabilitation, and replacement (OMRR&R) cost estimated at \$1,468,000 annually. The OMRR&R estimate includes about \$50,000 to monitor project performance and \$35,000 to monitor endangered species impacts (Cape Sable Seaside Sparrow). Ecological monitoring beyond the construction phase would be funded separately under the CERP Monitoring and Assessment Plan. In accordance with Section 601(e)(4), OMRR&R activities for ecosystem restoration are a non-Federal responsibility and would be shared equally between the Federal Government and the non-Federal sponsor. The project would be located on 12,176 acres west and south of Homestead in Miami-Dade County. The estimated cost of lands, easements, rights-of-way, and relocations for the recommended plan is \$68,451,000. The ecosystem restoration would cost about \$654 for each acre of habitat restored.

The project would also provide recreation opportunities. The estimated Total Project First Cost includes \$266,000 for recreation features, which include a trailhead with parking, traffic controls, a shade shelter with interpretive board, and approximately 6.8 miles of multi-use levee trails atop levees. The estimated Federal and the non-Federal costs of the recreation features would be \$133,000 each in accordance with Section 103(c) of the WRDA of 1986. The average annual cost for recreation is estimated at \$39,000, which includes \$25,000 for annual OMRR&R. The OMRR&R for recreation would be a non-Federal responsibility in accordance with Section 103(j) of

WRDA 1986. The average annual benefit for recreation is estimated at \$122,000, resulting in net average annual benefits of about \$83,000 and a benefit-to-cost ratio of about 3.1 to 1.

The total estimated Federal and the non-Federal costs for the project are \$82,549,000 each. The total average annual cost is estimated at \$10,268,000, which includes the total OMRR&R of about \$1,493,000 annually.

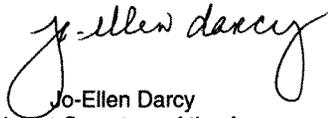
The SFWMD would be the non-Federal project sponsor and is legally capable of fulfilling those responsibilities. In accordance with Sections 601(h)(4)(A)(iii) (IV) and (V) of the WRDA of 2000, the SFWMD would be responsible for reserving available water and additional water made available by the project that would be necessary to achieve the project's restoration goals and objectives. The report states that the State of Florida will reserve or allocate for the natural system the additional water made available by the project. The project would not provide additional water for water supply or other water-related needs in the watershed. It also would not reduce levels of service for flood protection in accordance with Section 601(h)(5)(B) of the WRDA of 2000.

Section 601(e)(5)(B) of the WRDA of 2000 authorizes credit toward the non-Federal share for non-Federal design and construction work, subject to the execution of the design or project partnership agreement, and subject to a determination by the Secretary that the work is integral to the project. The SFWMD executed a Pre-Partnership Credit Agreement with the Department of the Army on August 13, 2009, in order to enable credit eligibility under Section 601(e)(5)(B) for certain work completed prior to an authorization of the project by the Congress and the execution of a project partnership agreement. The SFWMD completed the design and construction of about 90 percent of the restoration features in the proposed project in February 2012 and intends to seek credit under this agreement. The actual amount of credit to be afforded will be subject to audit and a determination that the work has been constructed in accordance with applicable Federal and State laws.

The Office of Management and Budget (OMB) advises that there is no objection to the submission of the report to Congress and concludes that the report recommendation is consistent with the policy and programs of the President. OMB also advises that should Congress authorize this project for construction, the project would need to compete with other proposed investments in future budgets. A copy of OMB's letter dated July 5, 2012, is enclosed. I am providing a copy of my letter to the House Committee on Transportation and Infrastructure's Subcommittee on Water Resources

and Environment, and the House Committee on Appropriations' Subcommittee on Energy and Water Development. I am providing an identical letter to the President of the Senate.

Very truly yours,

A handwritten signature in black ink that reads "Jo-Ellen Darcy". The signature is written in a cursive style with a large, looping initial "J".

Jo-Ellen Darcy  
Assistant Secretary of the Army  
(Civil Works)

Enclosures

10 Enclosures

1. Report of the Chief of Engineers, January 30, 2012
2. Environmental Protection Agency letter, February 23, 2011
3. Department of the Interior letter, March 7, 2011
4. Florida Dept. of Agriculture and Consumer Services letter, March 10, 2011
5. Federal Emergency Management Agency message, March 23, 2011
6. Florida Dept. of Environmental Protection letter, March 22, 2011
7. USACE response to Federal Emergency Management Agency, July 29, 2011
8. USACE response to Florida Dept. of Agriculture and Consumer Services,  
July 29, 2011
9. OMB Clearance Letter, July 5, 2012
10. Integrated Project Implementation Report and Environmental Impact Statement,  
January 2011



DEPARTMENT OF THE ARMY  
OFFICE OF THE CHIEF OF ENGINEERS  
WASHINGTON, D.C. 20314-1000

CECW-SAD (1105-2-10a)

JAN 3 0 2014

SUBJECT: C-111 Spreader Canal Western Project, Comprehensive Everglades Restoration Plan, Central and Southern Florida Project, Miami-Dade County, Florida.

THE SECRETARY OF THE ARMY

1. I submit for transmission to Congress my report on ecosystem restoration improvements for the C-111 Spreader Canal Western Project, located in Miami-Dade County, Florida. It is accompanied by the reports of the Jacksonville District Engineer and South Atlantic Division Engineer. These reports are in response to Section 601 of the Water Resources Development Act (WRDA) of 2000, which authorized the Comprehensive Everglades Restoration Plan (CERP) as a framework for modifications and operational changes to the Central and Southern Florida Project that are needed to restore, preserve, and protect the South Florida ecosystem while providing for other water-related needs of the region, including water supply and flood protection. WRDA 2000 identified specific requirements for implementing components of the CERP, including the development of a decision document known as a Project Implementation Report (PIR). The requirements of a PIR are addressed in this report and are subject to review and approval by the Secretary of the Army. Preconstruction engineering and design activities for this project will be continued under the CERP Design Agreement.

2. The proposed C-111 Spreader Canal project was conditionally authorized by Section 601(b)(2)(C)(x) of WRDA 2000, but is not being recommended for implementation under that authority. The proposed C-111 Spreader Canal project was split into Western and Eastern Projects. Due to changes in scope and intended restoration area, the C-111 Spreader Canal Western project will be recommended for new specific Congressional authorization consistent with WRDA 2000, Section 601(d), Authorization of Future Projects. The Western Project focuses on the restoration of flows to Florida Bay via Taylor Slough as well as the restoration of the Southern Glades and Model Lands. Due to numerous uncertainties associated with the actual spreader canal feature, a spreader canal design test will be implemented to gain information that will guide planning efforts for the Eastern Project. The Eastern Project will address the restoration of the remainder of the project area through such features as a spreader canal, backfilling of the C-111 Canal, etc. It is expected that the Eastern Project will also seek authorization under 601(d). The reporting officers determined that the original authority for the C-111 Spreader Canal Project contained 601(b)(2)(C)(x) of WRDA 2000 is no longer needed. As such, the reporting officers recommend that C-111 Spreader Canal authorized in 601(b)(2)(C)(x) of WRDA 2000 be deauthorized.

3. Although cost sharing of the ecosystem restoration features for this project is governed by Section 601 of WRDA 2000, as amended, cost sharing of the recreation features is governed by Section 103 of the WRDA 1986, as amended. In particular, in accordance with Section 103(j) of WRDA 1986, 100 percent of the cost of operation, maintenance, repair, replacement and rehabilitation (OMRR&R) of the recreation features is the non-Federal sponsor's responsibility. In

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addition, section 601(e)(5)(B) of WRDA 2000, as amended, governs credit for non-Federal sponsor design and construction work on the ecosystem restoration features of the project, whereas section 221(a)(4) of the Flood Control Act of 1970, as amended (42 U.S.C. 1962d-5b(a)(4)), governs credit for non-Federal sponsor design and construction work on the recreation features of the project.

4. The final PIR with integrated Environmental Impact Statement (EIS) recommends a project that contributes significantly to all of the ecological goals and objectives of the CERP: (1) increasing the spatial extent of natural areas; (2) improving habitat function and quality; and (3) improving native plant and animal abundance and diversity. In addition, it contributes to the economic values and social well being of the project area by providing recreational opportunities. Scientists have established that a mosaic of uplands, freshwater marsh, deep water sloughs, and estuarine habitats supporting a diverse community of fish and wildlife was one of the defining characteristics of the pre-drainage Everglades ecosystem. Currently in south Florida, habitat function and quality has significantly declined in remaining natural system areas due to water management projects and practices, resulting in a loss of suitable nesting, foraging, and fisheries habitat and a decline in native species diversity and abundance. The PIR confirms information in the CERP and provides project-level evaluation of costs and benefits associated with construction and operations of this ecosystem restoration project which will reverse the damaging trends and increase freshwater retention in Everglades National Park, restoring a natural deepwater slough and the surrounding freshwater marsh habitat. Water levels across the project area will be increased, boosting species abundance and diversity while providing suitable nesting and foraging areas for wading birds. Florida Bay and its estuaries will benefit from decreased salinity levels and improved health of the fisheries habitat. Overall, approximately 252,000 acres of wetlands and coastal habitat will benefit from the project. The South Florida Water Management District (SFWMD), the non-Federal sponsor, has begun land acquisition and construction of the project through its expedited construction program. As such, the C-111 Spreader Canal Western project can be implemented quickly, substantially advancing the realization of project benefits in an area that has been degraded by past water management practices.

5. The reporting officers recommend a plan for ecosystem restoration and recreation. The recommended C-111 Spreader Canal Western project would improve the ecological function of Everglades National Park by creating a hydraulic ridge that will reduce drainage of the area by the C-111 Canal. The Recommended Plan, Alternative 2DS, will consist of two above-ground detention areas, the approximately 590-acre Frog Pond Detention Area and an approximately 50-acre Aerojet Canal, which will serve to create a continuous and protective hydraulic ridge along the eastern boundary of Everglades National Park. Five additional features will be included that are intended to raise water levels in the eastern portion of the project area and restore wetlands in the Southern Glades and Model Lands. Major features of the detention areas include the construction of external levees and one approximately 225-cubic feet per second pump station for each detention area. The five additional features will include the following: incremental operational changes at existing structure S-18C; one new operable structure in the lower C-111 Canal; ten plugs in the C-110 Canal; operational changes at existing structure S-20; and, one plug in the existing L-31E Canal (near inoperable structure S-20A). Recreation components consist of a trailhead with parking, traffic controls, a shade shelter with interpretive board, and approximately 6.8 miles of multi-use levee trails atop impoundment levees. Restoration-compatible recreation includes hiking, biking, fishing, nature study, bird watching, state-managed hunts and equestrian use.

6. The cost of the initially authorized C-111 Spreader Canal component of the CERP, escalated to October 2011 (FY 12) price levels, is \$143,540,000. The total first cost of the Recommended Plan

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from the final PIR/EIS, based upon October 2011 price levels, is estimated at \$165,098,000. Total first cost for the ecosystem restoration features is estimated to be \$164,832,000 and for recreation is estimated to be \$266,000. The proposed project costs have increased primarily due to the fact that the project has increased in scope to address ecological problems in Everglades National Park and Florida Bay as identified by the public and stakeholders.

7. In accordance with the cost-sharing requirements of Section 601(e) of the WRDA 2000, as amended, the Federal cost of the Recommended Plan is \$82,549,000 and the non-Federal cost is \$82,549,000. The estimated lands, easements, right-of-way, and relocation (LERRs) costs for the recommended plan are \$68,451,000. LERRs valued at approximately \$18,610,000 are already owned by the State of Florida. Based on October 2011 price levels, a 40-year period of economic evaluation and a 4.0 percent discount rate, the equivalent annual cost of the proposed project is estimated at \$10,268,000, which includes OMRR&R, interest and amortization. The estimated annual costs for ecosystem restoration OMRR&R, including project monitoring costs, vegetation management, and endangered species monitoring, are \$1,468,000. The estimated annual OMRR&R costs for recreation are \$25,000. The project monitoring period is five years except for endangered species monitoring, which is 10 years. Any costs associated with project monitoring beyond 10 years after completion of construction of the Project (or a component of the Project) shall be a non-Federal responsibility.

8. As a component of the CERP program, the interagency/interdisciplinary scientific and technical team, formed to ensure that system-wide goals are met, will participate in the annual monitoring to assess system-wide changes. In accordance with Sections 601(e)(4) and 601(e)(5)(D) of WRDA 2000, as amended, OMRR&R costs and adaptive assessment and monitoring costs for ecosystem restoration will be shared equally between the Federal Government and the non-Federal sponsor. The Project Monitoring Plan was developed assuming that major, ongoing monitoring programs that are not funded by the Project would continue to supply data relevant to the Project. The Project Monitoring Plan shall not include items that are already required to be monitored by another Federal agency or other entity as part of their regular responsibilities or required by law. Should any of these monitoring programs (e.g. coastal water quality and seagrass monitoring) be discontinued or significantly curtailed, then monitoring priorities and funding options may be re-evaluated to ensure proper Project evaluation. In accordance with Section 103(j) of the WRDA 1986, as amended, OMRR&R costs related to recreation features will be funded 100 percent by the non-Federal sponsor.

9. To ensure that an effective ecosystem restoration plan was recommended, cost effectiveness/incremental cost analysis techniques were used to evaluate alternative restoration plans. These techniques determined the selected alternative plan to be cost effective and incrementally justified. The hydraulic model and ecological model utilized to estimate the ecological outputs that were used in the economic analysis were both peer-reviewed and certified for use in the project. The plan recommended for implementation is the National Ecosystem Restoration (NER) plan, supports the Incremental Adaptive Restoration principles established by the National Research Council, and was prepared in a collaborative environment. The recommended plan provides benefits by: (1) restoring the quantity, timing, and distribution of water delivered to Florida Bay via Taylor Slough; (2) improving hydroperiods and hydropatterns in the Southern Glades and Model Lands; and, (3) restoring coastal zone salinities in Florida Bay and its tributaries.

10. In accordance with the WRDA 2000 Section 601(f)(2), individual CERP projects may be justified by the environmental benefits derived by the South Florida ecosystem. Similarly, Section

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385.9(a) of the CERP Programmatic Regulations (33 CFR Part 385) requires that individual projects shall be formulated, evaluated, and justified based on their ability to contribute to the goals and purposes of the CERP and on their ability to provide benefits that justify costs on a next-added increment basis. Due to the project location at the terminus of the Everglades system, the C-111 Spreader Canal Western project does not depend on any other CERP or non-CERP projects to achieve the estimated ecological benefits. As such, the Next-Added Increment (NAI) is equivalent to the total, System-Wide benefits that were calculated for the proposed project. The Recommended Plan will produce an average annual increase of 8,271 habitat units per year at an annual cost of \$10,268,000. In coordination with Fish and Wildlife Service, this project could benefit threatened and endangered species and migratory birds. The average annual cost per average annual habitat unit is \$1,240. Based on restoration first cost, the cost per acre benefited is approximately \$654 per acre. Based on these parameters, the C-111 Spreader Canal Western project is justified by the environmental benefits derived by the South Florida ecosystem. The recreation first cost of the recommended plan is \$266,000. The average annual cost for recreation is \$39,000 and the average annual recreation benefits are \$122,000, providing a benefit cost ratio of 3.1 to 1.

11. Of the 12,176 acres of land identified for the Project, approximately 611 acres were provided as items of local cooperation for existing Federal projects and will be used for construction of C-111 Spreader Canal Western Project. Approximately 11,565 acres of land are predicted to be impacted by the Recommended Plan: Approximately 9,688 acres will be provided in fee and have already been purchased by the non-Federal sponsor. Approximately 146 acres of impacted lands will be provided under a supplemental agreement with the State of Florida and Miami-Dade County. Approximately 955 acres will be provided by perpetual flowage/conservation easements by the Florida Power and Light Company. The planning level model predicted that the remaining 776 acres of privately-owned land identified for the Project may be affected by operation of the Project, as indicated in the PIR. WRDA 2000 requires that implementation of the CERP shall not reduce existing levels of service for flood protection. The SFWMD is constructing the majority of the project under its State expedited construction program and as part of its independent effort to implement the Project, the SFWMD will monitor the impacts of the current construction and continually adjust operations to ensure the protection of privately-owned lands. If SFWMD is able to provide new information that these operations provide anticipated ecological benefits without reducing existing levels of service for flood protection for the 776 acres, the Corps will consider this information and accordingly document any changes to its takings analysis and the continued compliance with the statutory requirements regarding maintenance of level of service for flood protection. The reassessment of effects on existing levels of service for flood protection will utilize a method similar to the original method of determination. Like the analysis in the PIR, the reassessment will be conducted in a manner consistent with the CERP Programmatic Regulations and guidance. In addition, the takings analysis will be similarly reassessed. Any reassessment done will be completed prior to the execution of a Project Partnership Agreement (PPA). The new information must document that operational adjustments implemented to avoid a reduction of the level of service for flood protection on a particular property or properties can also provide the anticipated ecological benefits. After the documentation is complete, then those operations may be made permanent and incorporated into the Final Project Operating Manual of the Federally-authorized project. Otherwise, the non-Federal sponsor will acquire the necessary interests in the lands, and will provide real estate certification of those lands to the Corps.

12. In accordance with the Corps Engineering Circular on review of decision documents, all technical, engineering, and scientific work underwent an open, dynamic, and vigorous review

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process to ensure technical quality. This included Agency Technical Review (ATR), and Independent External Peer Review (IEPR), and a Corps Headquarters policy and legal review. All concerns of the ATR have been addressed and incorporated into the final report. The IEPR was completed by Battelle Memorial Institute, a non-profit science and technology organization with experience in establishing and administering peer review panels for the Corps. A total of 23 comments were documented. The comments of high significance were related to current and future conditions, assessment of secondary effects and climatic cycles, and technical sections of the document such as Real Estate and Modeling. In response, sections in the PIR/EIS and appendices were expanded to include additional information. The final IEPR Report was completed in October 2009, and certification from the IEPR Panel was issued 25 November 2009.

13. The Final PIR/EIS was published for State and Agency Review on 4 February 2011. The majority of the comments received were favorable and in support of the project. A letter from the Florida Department of Agriculture and Consumer Services (FDACS), dated 10 March 2011, stated a concern that the proposed project would result in negative impacts to privately-owned agricultural lands in the vicinity of the project. Specifically, the concern was that a rise in groundwater elevations would result in root zone flooding that would be detrimental to crops. The FDACS also expressed concern that any adverse impacts identified after project implementation would be based upon criteria not specified in the Final PIR. In a 29 July 2011 reply letter, the Corps responded to these concerns by describing the monitoring being conducted by the SFWMD as part of its expedited construction program and the Corps' consideration of additional information to reassess the takings analysis and whether the project will reduce the existing levels of service for flood protection on the 776 acres, or a portion thereof, as described previously in Paragraph 11. The final PIR was revised to clarify this position.

14. Section 601(e)(5)(B) of WRDA 2000, as amended by Section 6004 of the WRDA 2007, authorizes credit toward the non-Federal share for non-Federal design and construction work completed during the period of design or construction, subject to execution of the design or project partnership agreement and subject to a determination by the Secretary that the work is integral to the project. As part of its initiative for early implementation of certain CERP projects, the non-Federal sponsor has stated that it is constructing the C-111 Spreader Canal Western project consistent with the PIR, in advance of Congressional authorization and the signing of a project partnership agreement. As such, a separate EIS has been completed and a Department of the Army permit has been issued to the non-Federal sponsor for expedited construction of this project, and construction of the project has already begun by the State of Florida. As required by the February 2008 Implementation Guidance for Section 6004 of WRDA 2007 – CERP Work In-Kind Credits, the non-Federal sponsor entered into a Pre-Partnership Credit Agreement for the C-111 Spreader Canal Western Project on 13 August 2009. The reporting officers believe that it is in the public interest for this Project to be implemented expeditiously due to the early restoration of Federal lands in Everglades National Park and ecological benefits to the wetlands and estuaries in other portions of the South Florida ecosystem. Therefore, the reporting officers recommend that the non-Federal sponsor be credited for all reasonable, allowable, necessary, auditable, and allocable costs applicable to the C-111 Spreader Canal Western project as may be authorized by law including those incurred prior to the execution of a PPA, subject to authorization of the Project by law, a determination by the Assistant Secretary of the Army (Civil Works) or his/her designee that the In-kind work is integral to the authorized CERP Project, that the costs are reasonable, allowable, necessary, auditable, and allocable, and that the In-kind work has been implemented in accordance with government standards and applicable Federal and state laws.

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15. The non-Federal Sponsor and the U.S. Department of the Army entered into an agreement known as the Master Agreement Between the Department of the Army and South Florida Water Management District for Cooperation in Constructing and Operating, Maintaining, Repairing, Replacing and Rehabilitating Projects Authorized to be Undertaken Pursuant to the Comprehensive Everglades Restoration Plan dated 13 August 2009 (hereinafter "Master Agreement"). The Master Agreement sets forth the terms of participation in the construction and OMRR&R of projects under CERP that will apply to any future project for which the non-Federal sponsor and the Government have entered into a PPA. The uniform terms of the Master Agreement will be incorporated by reference into the C-111 Spreader Canal Western Project PPA.

16. Credits for non-Federal design and construction will be evaluated in accordance with the terms of the Master Agreement. All documentation provided by the non-Federal sponsor will be thoroughly reviewed by the Corps to determine reasonable, allowable, necessary, auditable, and allocable costs. Upon completion of this review, a financial audit will be conducted prior to granting final credit. Coordination between the Corps and the Sponsor will occur throughout design and construction via the Corps' Regulatory process. The credit afforded to the non-Federal sponsor will be limited to the lesser of the following: (1) actual costs that are reasonable, allowable, necessary, auditable, and allocable to the Project; or (2) the Corps estimate of the cost of the work allocable to the Project had the Corps performed the work. The non-Federal sponsor intends to implement this work using its own funds and would not use funds originating from other Federal sources unless the Federal granting agency verifies in writing that the expenditure of such funds is expressly authorized by statute and in accordance with Section 601 (e)(3) of WRDA 2000 as amended and the Master Agreement.

17. Washington level review indicates that the plan recommended by the reporting officers is environmentally justified, technically sound, cost effective, and socially acceptable. The plan conforms to essential elements of the U.S. Water Resources Council's Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies and complies with other administration and legislative policies and guidelines. The views of interested parties, including Federal, state and local agencies have been considered.

18. The Project complies with the following requirements of the WRDA 2000, as amended:

a. Project Implementation Report (PIR). The requirements of a PIR as defined by Section 601(h)(4)(A).

b. Reservation or Allocation of Water for the Natural System. Sections 601(h)(4)(A)(iii)(IV) and (V) require identification of the appropriate quantity, timing, and distribution of water dedicated and managed for the natural system and the amount of water to be reserved or allocated for the natural system. In accordance with the regulations, an analysis was conducted to identify water dedicated and managed for the natural system. Accordingly, the non-Federal sponsor will protect the water that was identified as necessary to achieve the benefits of the Project, using water reservation or allocation authority under Florida law.

c. Elimination or Transfer of Existing Legal Sources of Water. Section 601(h)(5)(A) states that existing legal sources of water shall not be eliminated or transferred until a new source

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of water supply of comparable quantity and quality is available to replace the water to be lost as a result of the CERP. An analysis of project effects on existing legal sources of water was conducted and it was determined that implementation of the C-111 Spreader Canal Western project will not result in a transfer or elimination of existing legal sources of water.

d. Maintenance of Flood Protection. Section 601 (h)(5)(B) states that the Plan shall not reduce levels of service for flood protection that are in existence on the date of enactment of WRDA 2000 (December 2000) and in accordance with applicable law. Potential flooding effects as a result of the proposed project were analyzed and the results indicated that the proposed project would have an adverse impact on the level of service for flood protection in the project area. The analysis identified 776 acres of privately-owned lands that may be impacted as a result of the operation of the proposed project. Total impacted lands, including the 776 acres identified above, were approximately 11,565 acres. As such, the non-Federal sponsor will provide the 11,565 acres of lands either in fee, perpetual flowage easements, or by supplemental agreements, and will be responsible for those real estate interests as a project cost. Under the specific circumstances detailed in paragraph 11, the non-Federal sponsor may not be required to provide an interest in all or part of the 776 acres of privately-owned lands identified.

19. I generally concur with the findings, conclusions, and recommendations of the reporting officers. Accordingly, I recommend that the plan described herein for ecosystem restoration and recreation be authorized for implementation as a Federal Project, with such modifications as in the discretion of the Chief of Engineers may be advisable, and subject to cost-sharing, financing, and other applicable requirements of Section 601 of WRDA 2000, as amended. In addition, I recommend that the non-Federal sponsor be authorized to receive credit for work accomplished prior to execution of a PPA for this Project, in accordance with the terms described in paragraphs 14 and 16 of this report.

Further, this recommendation is subject to the non-Federal sponsor agreeing to comply with all applicable Federal laws and the following items of local cooperation:

- a. Provide 50 percent of total project costs consistent with the provisions of Section 601(e) of the WRDA 2000, as amended, including authority to perform design and construction of project features consistent with Federal law and regulation.
- b. Provide all lands, easements, and rights-of-way, including suitable borrow and dredged or excavated material disposal areas, and perform or assure the performance of all relocations that the Government and the non-Federal sponsor jointly determine to be necessary for the construction and OMRR&R of the Project and valuation will be in accordance with the Master Agreement.
- c. Shall not use the ecosystem restoration features or lands, easements, and rights-of-way required for such features as a wetlands bank or mitigation credit for any other non-CERP projects.
- d. Give the Government a right to enter, at reasonable times and in a reasonable manner, upon land that the non-Federal sponsor owns or controls for access to the Project for the

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purpose of inspection, and, if necessary, for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the Project.

e. Assume responsibility for operating, maintaining, repairing, replacing, and rehabilitating the Project or completed functional portions of the Project in a manner compatible with the Project's authorized purposes and in accordance with applicable Federal and State laws and specific directions prescribed in the OMRR&R manuals and any subsequent amendments thereto. Notwithstanding Section 528(e)(3) of WRDA 1996 (110 Stat. 3770), the non-Federal sponsor shall be responsible for 50 percent of the cost of OMRR&R activities authorized under this section.

f. The non-Federal sponsor shall operate, maintain, repair, replace and rehabilitate the recreational features of the Project and is responsible for 100 percent of the costs.

g. Keep the recreation features, and access roads, parking areas, and other associated public use facilities, open and available to all on equal terms.

h. Unless otherwise provided for in the statutory authorization for this Project, comply with Section 221 of PL 91-611, Flood Control Act of 1970, as amended, and Section 103 of the WRDA of 1986, PL 99-662, as amended which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until the non-Federal sponsor has entered into a written agreement to furnish its required cooperation for the Project or separable element.

i. Hold and save the Government free from all damages arising from the construction, OMRR&R of the Project, and any project-related betterments, except for damages due to the fault or negligence of the Government or the Government's contractors.

j. Keep and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the Project to the extent and in such detail as will properly reflect total project costs and comply with the provisions of the CERP Master Agreement between the Department of Army and the South Florida Water Management District for Cooperation in Constructing and Operating, Maintaining, Repairing, Replacing, and Rehabilitating Projects Authorized to be Undertaken Pursuant to the Comprehensive Everglades Restoration Plan, executed on 13 August 2009, including Article XI Maintenance of Records and Audit.

k. Perform, or cause to be performed, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 USC 9601-9675, that may exist in, on, or under lands, easements or rights-of-way necessary for the construction and operation and maintenance (O&M) of the Project; except that the non-Federal sponsor shall not perform such investigations on lands, easements, or rights-of-way that the Government determines to be subject to the navigation servitude without prior specific written direction by the Government.

l. Assume complete financial responsibility for all necessary cleanup and response costs of any CERCLA regulated materials located in, on or under lands, easements, or right-of-ways

SUBJECT: C-111 Spreader Canal Western Project. Comprehensive Everglades Restoration Plan, Central and Southern Florida Project, Miami-Dade County, Florida.

necessary for the construction and OMRR&R.

m. As between the Government and the non-Federal sponsor, the non-Federal sponsor shall be considered the operator of the Project for the purposes of CERCLA liability. To the maximum extent practicable, the non-Federal sponsor shall OMRR&R the Project in a manner that will not cause liability to arise under CERCLA.

n. Prevent obstructions of and encroachments on the Project (including prescribing and enforcing regulations to prevent such obstruction or encroachments) which might reduce ecosystem restoration benefits, hinder O&M, or interfere with the Project's proper function, such as any new developments on Project lands or the addition of facilities which would degrade the benefits of the Project.

o. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, PL 91-646, as amended by the title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987 (PL 100-17), and Uniform Regulations contained in 49 CFR part 24, in acquiring lands, easements, and rights-of-way, and performing relocations for construction, O&M of the Project, and inform all affected persons of applicable benefits, policies, and procedures in connection with said act.

p. Comply with all applicable Federal and State laws and regulations, including, but not limited to, Section 601 of the Civil Rights Act of 1964, PL 88-352, and Department of Defense Directive 5500.11 issued pursuant thereto, as well as Army Regulation 600-7, entitled, "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army," and all applicable Federal labor standards and requirements including, but not limited to, 40 U.S.C. 3141-3148 and 40 U.S.C. 3701-3708 (revising, codifying and enacting without substantive change the provisions of the Davis-Bacon Act [formerly 40 U.S.C. 276a et seq.], the Contract Work Hours and Safety Standards Act [formerly 40 U.S.C. 327 et seq.] and the Copeland Anti-Kickback Act [formerly 40 U.S.C. 276c]).

q. Comply with Section 106 of the National Historic Preservation Act in completion of all consultation with Florida's State Historic Preservation Office and, as necessary, the Advisory Council on Historic Preservation prior to construction as part of the Pre-construction Engineering and Design phase of the Project.

r. Provide 50 percent of that portion of total cultural resource preservation mitigation and data recovery costs attributable to the Project that are in excess of one percent of the total amount authorized to be appropriated for the Project.

s. Do not use Federal funds to meet the non-Federal sponsor's share of total project costs unless the Federal granting agency verifies in writing that the expenditure of such funds is expressly authorized and in accordance with Section 601(e)(3) of WRDA 2000.

t. The non-Federal sponsor agrees to participate in and comply with applicable Federal floodplain management and flood insurance programs consistent with its statutory authority.

**SUBJECT: C-111 Spreader Canal Western Project. Comprehensive Everglades Restoration Plan, Central and Southern Florida Project, Miami-Dade County, Florida.**

(1) Not less than once each year the non-Federal sponsor shall inform affected interests of the extent of protection afforded by the Project.

(2) The non-Federal sponsor shall publicize flood plain information in the area concerned and shall provide this information to zoning and other regulatory agencies for their use in preventing unwise future development in the flood plain and in adopting such regulations as may be necessary to prevent unwise future development and to ensure compatibility with protection levels provided by the Project.

(3) The non-Federal sponsor shall comply with Section 402 of WRDA 1986, as amended (33 U.S.C. 701b-12), which requires a non-Federal interest to have prepared, within one year after the date of signing a project partnership agreement for the Project, a floodplain management plan. The plan shall be designed to reduce the impacts of future flood events in the project area, including but not limited to, addressing those measures to be undertaken by non-Federal interests to preserve the level of flood protection provided by the Project. As required by Section 402, as amended, the non-Federal interest shall implement such plan not later than one year after completion of construction of the Project. The non-Federal sponsor shall provide an information copy of the plan to the Government upon its preparation.

(4) The non-Federal sponsor shall prescribe and enforce regulations to prevent obstruction of or encroachment on the Project or on the lands, easements, and rights-of-way determined by the Government to be required for the construction, operation, maintenance, repair, replacement, and rehabilitation of the Project, that could reduce the level of protection the Project affords, hinder operation or maintenance of the Project, or interfere with the Project's proper function.

u. The non-Federal Sponsor shall execute under State law the reservation or allocation of water for the natural system as identified in the PIR for this authorized CERP Project as required by Sections 601(h)(4)(B)(ii) of WRDA 2000 and the non-Federal Sponsor shall provide information to the Government regarding such execution. In compliance with 33 CFR 385, the District Engineer will verify such reservation or allocation in writing. Any change to such reservation or allocation of water shall require an amendment to the PPA after the District Engineer verifies in writing in compliance with 33 CFR 385 that the revised reservation or allocation continues to provide for an appropriate quantity, timing, and distribution of water dedicated and managed for the natural system after considering any changed circumstances or new information since completion of the PIR for the authorized CERP Project.

20. The recommendation contained herein reflects the information available at this time and current Departmental policies governing formulation of individual projects. It does not reflect program and budgeting priorities inherent in the formulation of a national civil works construction program or the perspective of higher review levels within the executive branch. Consequently, the recommendation

**SUBJECT: C-111 Spreader Canal Western Project. Comprehensive Everglades Restoration Plan, Central and Southern Florida Project, Miami-Dade County, Florida.**

**may be modified before it is transmitted to the Congress as a proposal for authorization and implementation funding.**



**MERDITH W.B. TEMPLE**  
Major General, USA  
Acting Chief of Engineers



**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**

REGION 4  
SAM NUNN  
ATLANTA FEDERAL CENTER  
61 FORSYTH STREET  
ATLANTA GEORGIA 30303-8960

February 23, 2011

Dr. Rebecca S. Griffith, PMP  
Chief, Planning Division  
Jacksonville District  
U.S. Army Corps of Engineers  
P.O. Box 4970  
Jacksonville, FL 32232-0019

**Subject: Comments on the Final Integrated Project Implementation Report and the Final Environmental Impact Statement (FEIS) for the "C-111 Spreader Canal Western Project, To Restore Ecosystem Function in Taylor Slough and Florida Bay Areas, Central and Southern Florida Project, Comprehensive Everglades Restoration Plan (CERP), Everglades National Park, Miami - Dade County, Florida"**  
**CEQ Number: 20110029, ERP Number: COE-E39078-FL**

Dear Dr. Griffith,

Pursuant to Section 309 of the Clean Air Act (CAA) and Section 102(2)(c) of the National Environmental Policy Act (NEPA), the U.S. Environmental Protection Agency (EPA) Region 4 has reviewed the combined Final Integrated Project Implementation Report and the Final Environmental Impact Statement (FEIS) for the C-111 Spreader Canal Western Project. This project is located in south Miami-Dade County and has been proposed to restore ecosystem function in Taylor Slough and Florida Bay within the Everglades National Park, the adjacent Southern Glades, the Model Lands, and other associated wetlands and estuarine systems.

EPA understands that this Comprehensive Everglades Restoration Plan (CERP) project, sponsored by the South Florida Water Management District (SFWMD), has changed from its original Restudy design and was divided into a Western and Eastern Project. The present Western Project primarily addresses changes in western flows through Taylor Slough to restore over 250,000 acres of wetlands/habitat and to moderate and stabilize salinities in Florida Bay. The Eastern Project will cover the remaining project area and ultimately include the backfilling of the C-111 Canal. EPA previously rated the Western Project Draft Environmental Impact Statement (DEIS) as an "LO" (Lack of Objections), and we expressed our support for the C-111 Spreader Canal Western Project in our letter to the Jacksonville District dated June 8, 2009. EPA

continues to believe that this project, as well as the related Eastern Project, will benefit the CERP sponsored ecological recovery of the Everglades and Florida Bay.

EPA understands that the groundbreaking for the first phase of the C-111 spreader canal restoration project was recently held on Tuesday, January 26, 2011, and will soon restore the historical freshwater flows necessary to recover the former productive levels of aquatic species, wading birds and wildlife in Florida Bay. The successful completion and operation of the first phase of this restoration project will create a 9-mile “hydraulic ridge” designed to shift water toward Taylor Slough, the intended freshwater entry point to Florida Bay. Wetlands in this area have had limited freshwater for many years (since the early 1960’s), with a concurrent decreased productivity of prey species that support wading bird populations.

EPA has previously provided NEPA-related comments on this project in letters dated June 8, 2009 and August 12, 2009 (both are attached), and we appreciate the Jacksonville District’s incorporation of our comments in the Final Integrated Project Implementation Report and the Final Environmental Impact Statement (FEIS). Our previous comments and follow-up responses are included below.

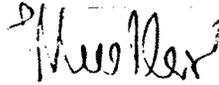
- EPA-1 (Water Quality) – As we previously commented in our August 12, 2009 letter, EPA appreciates the addition of a water quality improvements discussion to Section 7.8.2 and in the discussion of Alternative 2D Short. In the same letter we requested that water quality benefits provided directly by the project or indirectly (e.g., sponsor land acquisition-removal from farming and potential development) be added to the FEIS. This was primarily because a major component of CERP is for water quality improvement of the Everglades - not just water quantity improvements (rehydration). EPA understands that all CERP projects have a water quality component or will benefit water quality to some degree. The water quality discussion in Section 7.8.2 now includes a statement noting that the change in land use will result in improved water quality conditions. The same statement has been added to the discussion for Alternative 2D Short. However, the FEIS clarifies that the project is not targeting water quality improvement specifically, and any water quality benefits as a result of project implementation are to be considered “ancillary”.
- EPA-2 (Correct figures) – As we previously requested, Figure E-2 has been recently re-worked to provide greater understanding of monitoring station locations, and to better align it with the information in Table E-1 and in the text. S176B and S100 have been changed throughout the document to reflect the correct names: S-200 and S-199 respectively.
- EPA-3 (Monitoring Plan) - We previously found the Project Monitoring Plan in the FEIS to be responsive to our comments on the DEIS. The full monitoring plan is detailed in Annex E of the FEIS. The ecological monitoring parameters will reportedly follow “known standards” to determine if the project is performing as envisioned.
- EPA-4 (Environmental Justice) – As we previously noted, EPA understands that no public EJ issues were raised at a recent public meeting or otherwise identified

during the NEPA process. EPA understands that there will be no environmental impacts that are “high, adverse, or disproportionate” to low income, minority, or tribal populations as a result of the proposed project.

- EPA-5 (Displacement of people or businesses) - At this time, EPA understands that the Jacksonville District is not aware of any residents or businesses that will be displaced by the proposed project.
- EPA-6 (Invasive Species) – EPA notes that a Vegetation Management Plan, including requirements for invasive species control, has been developed and is contained in Annex E.
- EPA-7 (Cumulative Impacts) – EPA notes that the Western project anticipates more water from other CERP projects. We understand that this analysis was included in the system-wide formulation contained in Section 5 of the PIR/EIS. Direct effects from other projects are not anticipated; only indirect effects.

Thank you for the opportunity to provide comments on this final report. We appreciate the responses in the FEIS to our concerns, and we recommend that any remaining issues should be addressed in the ROD. If you wish to discuss these comments or have any other questions, please contact me at (404) 562-9611 ([mueller.heinz@epa.gov](mailto:mueller.heinz@epa.gov)) or Paul Gagliano, P.E., of my staff at (404) 562-9373 ([gagliano.paul@epa.gov](mailto:gagliano.paul@epa.gov)).

Sincerely,



Heinz J. Mueller, Chief  
NEPA Program Office  
Office of Policy and Management

Attachment:

EPA Review Comments (dated August 12, 2009) on the COE's "C-111 Spreader Canal Western Project Final Project Implementation Report and Environmental Impact Statement"; Everglades and Florida Bay; CEQ# 20090243; ERP# COE-E39078-FL

EPA Review Comments (dated June 8, 2009) on the COE's "C-111 Spreader Canal Western Project Draft Project Implementation Report and Environmental Impact Statement"; CEQ# 20090117; ERP# COE-E39078-FL



**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**

REGION 4  
 ATLANTA FEDERAL CENTER  
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August 12, 2009

Ms. Alisa Zarbo  
 U.S. Army Corps of Engineers  
 Jacksonville District  
 Regulatory Division  
 Palm Beach Gardens Regulatory Office  
 4400 PGA Boulevard / Suite 500  
 Palm Beach Gardens, FL 33410

**Subject: EPA Review of the COE's "C-111 Spreader Canal Western Project Final Project Implementation Report and Environmental Impact Statement"; Everglades and Florida Bay; CEQ# 20090243; ERP# COE-E39078-FL**

Dear Ms. Zarbo:

Pursuant to Section 102(2)(C) of the National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act, the U.S. Environmental Protection Agency (EPA) has reviewed the U.S. Army Corps of Engineers' (COE) Final Environmental Impact Statement (FEIS) for the subject C-111 Spreader Canal (C-111 SC) Western Project. This Comprehensive Everglades Restoration Plan (CERP) project sponsored by the South Florida Water Management District (SFWMD) has changed from its original Restudy design and was divided into a Western and Eastern Project. The present Western Project primarily addresses changes in western flows through Taylor Slough to restore wetlands and to moderate/stabilize salinities in Florida Bay. The prospective Eastern Project is to cover the remaining project area and ultimately include the backfilling of the C-111 Canal. EPA has previously provided comments on the Draft EIS (DEIS) in a letter dated June 8, 2009.

As was the case with the DEIS, EPA has concurrently received a copy of the Final Environmental Assessment (FEA) on the "C-111 Spreader Canal Design Test", which will serve as a pilot study for the design of the Eastern Project. The Spreader Canal feature will not be implemented under the current C-111 SC Western Project but is expected to be a major component of the overall project. We continue to support such pilot studies and will defer to the COE on this demonstration without formal comment. However, we assume that the FEA is consistent with the objectives of the present FEIS and improves water quantity and quality in the project area.

We appreciate the COE's responses to our comments on the DEIS. These responses are found on page B-105 of Annex B in Volume 3, and a copy of our letter was provided on page B-57. We have concentrated our FEIS review on those responses. We offer the following final comments in support of the C-111 SC Western Project:

o EPA-1 (Water Quality) – We appreciate the water quality improvements to Section 7.8.2 and in the discussion of Alternative 2DShort regarding the expected water quality improvements due to the project. However, it is unclear why the ‘EPA-1’ response states that “...the project is not targeting water quality improvement...”, given that a major component of CERP is the water quality improvement of the Everglades – not just water quantity improvements (rehydration) – in the overall restoration of the Everglades. All CERP projects should therefore have a water quality component or that benefits water quality at some capacity.

o EPA-3 (Monitoring Plan) – We find the Project Monitoring Plan in the FEIS to be responsive to our comments on the DEIS.

o EPA-4 (Environmental Justice: EJ) – We are pleased to understand from this response that no public EJ issues were raised at a recent public meeting or determined. We note from Section 5.6.4.2 that a stakeholders meeting took place in 2003. However, we also note that Section 5.6.4.2 in the DEIS was not modified in the FEIS. It is therefore unclear if these stakeholders included or represented potentially affected EJ groups (what public outreach was used to assemble stakeholders?), and if conditions have changed since 2003.

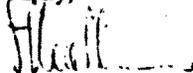
o EPA-6 (Invasive Species) – Although reduction and control of invasive species in the project areas to be rehydrated is not required, it would benefit the overall CERP goal of Everglades restoration. Such restoration should emphasize native wetland species as opposed to invasives.

o EPA-7 (Cumulative Effects) – The *Cumulative Effects* section (7.25: pg. 7-32) is much improved due to its disclosure of related CERP projects that indirectly affect the C-111 SC Western Project. Section 7.25.2 would have benefitted by inclusion of the relative merits of the present Western Project versus the proposed Eastern Project.

In summary, EPA continues to support the C-111 SC Western Project. We believe that this project and its proposed Eastern Project counterpart should benefit the CERP recovery of the Everglades and Florida Bay. We therefore recommend that implementation be expedited.

We appreciate the opportunity to review the FEIS. Should you have questions regarding these comments, feel free to contact Chris Hoberg of my staff for NEPA issues (404-562-9619 or [hoberg.chris@epa.gov](mailto:hoberg.chris@epa.gov)) and Eric Hughes of the EPA Water Protection Division (located in the Jacksonville District office) for technical issues (904/232-2464 or [hughes.eric@epa.gov](mailto:hughes.eric@epa.gov)).

Sincerely,



Heinz J. Mueller, Chief  
NEPA Program Office

**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**

REGION 4

ATLANTA FEDERAL CENTER  
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June 8, 2009

Dr. Rebecca S. Griffith  
Chief, Planning Division  
U.S. Army Corps of Engineers  
Jacksonville District  
P.O. Box 4970  
Jacksonville, FL 32232-0019

ATTN: Bradley Tarr

Subject: EPA Review of the COE's "C-111 Spreader Canal Western Project Draft Project Implementation Report and Environmental Impact Statement"; CEQ# 20090117; ERP# COE-E39078-FL.

Dear Dr. Griffith:

Pursuant to Section 102(2)(C) of the National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act, the U.S. Environmental Protection Agency (EPA) has reviewed the U.S. Army Corps of Engineers' (COE) Draft Environmental Impact Statement (DEIS) for the subject C-111 Spreader Canal (C-111 SC) Western Project. This Comprehensive Everglades Restoration Plan (CERP) project sponsored by the South Florida Water Management District (SFWMD) has changed from its original Restudy design and was divided into a Western and Eastern Project. The present Western Project primarily addresses changes in western flows through Taylor Slough to restore wetlands and to moderate/stabilize salinities in Florida Bay. The prospective Eastern Project is to cover the remaining project area and ultimately include the backfilling of the C-111 Canal.

Concurrently with this DEIS, EPA also received a copy of the Draft Environmental Assessment (DEA) on the "C-111 Spreader Canal Design Test", which will serve as a pilot study for the design of the Eastern Project. The Spreader Canal feature will not be implemented under the current C-111 SC Western Project but is expected to be a major component of the overall project. We support such pilot studies and will defer the finalization of the DEA to the COE, since we assume that the resultant Final EA (FEA) will be consistent with the objectives of the present DEIS and improve water quantity and quality in the project area. Accordingly, we recommend that the development of the FEA remain within the context of the DEIS and apply our present comments on the DEIS as appropriate.

## Background

The DEIS for the C-111 SC Western Project addresses the restoration of the ecological functions of Taylor Slough and Florida Bay in the Everglades National Park (ENP), for the benefit of Florida Bay, Southern Glades, Model Land and other wetland and estuarine areas. The Western Project is essential in the CERP restoration of downstream waters to Florida Bay through Taylor Slough using available waters. The project would function to regulate and improve the quantity, timing and distribution (QTD) of these flows and to increase hydroperiods. Several structural changes are proposed, including the creation of a nine-mile-long hydraulic ridge east of the ENP and a water control structure in the lower portion of C-111, as well as modifications of existing S-18C, S-20, S-20A and the C-110 Canal. The hydraulic ridge is to consist of the Frog Pond Retention Area and Aerojet Canal west of the C-111 Canal, and their pumping stations. This ridge is to prevent groundwater flows from entering the Canal from the ENP, so that the groundwater is retained in Taylor Slough for downstream conveyance. Also, the C-110 Canal east of the C-111 Canal will be filled periodically with 10 earthen plugs to promote downstream re-hydration flooding and sheet flow of its waters.

EPA supports the C-111 SC Western (and prospective Eastern) Project. We recognize the restoration benefits of wetland re-hydration and increased hydroperiods, and the diversion of flows to Florida Bay through Little Madera Bay and Joe Bay to moderate and stabilize salinity for their estuarine flora and fauna. Moreover, the project would re-hydrate the wetlands of the Model Lands enabling thousands of wetland acres to function better and become available for mitigation banking. Compared to the current C-111 Canal discharges into receiving waters, diversion of these canal waters should also improve downstream water quality by creating overland sheet flow. We also understand that project pumping will be controlled to accommodate a project constraint to maintain acceptable low water depths for the endangered Cape Sable Seaside Sparrow. Overall, this proposal would affect some 155,000 acres of uplands, wetlands and estuarine areas (pg. 2-2), and include 776 acres of private land acquisition by the SFWMD sponsor. Response times for re-hydration and salinity-moderation benefits could range from immediate for some sessile and opportunistic species to a slower rebound of up to 10 years for others that would eventually colonize the area or that have long life cycles.

## Alternatives

The COE's Recommended Plan (=NEPA preferred alternative) proposed in the DEIS is Alternative 2D Short (2DS), which is a modification of the original Alternative 2D. Alternative 2DS proposes a shorter Aerojet Canal feature that is more compatible with the volume of water available. The original Alternative 2D was consequently renamed as Alternative 2D Long (2DL).

Overall, EPA believes that Alternative 2DS is a reasonable environmental and economic selection. Of the final array of alternatives (1C, 1D, 3D, 2DL, 2DS, 6D), it provides a high habitat unit benefit or "lift", second only to 6D. Alternative 2DS should

also reduce salinity swings in Barnes Sound by reducing freshwater flows through S-197, but increase flows to Florida Bay to moderate salinities there to more historic levels. From a cost perspective, start-up and maintenance costs of Alternative 2DS and 6D were each characterized by the COE as a "Best Buy"; however, 2DS would cost considerably less and provides better relative benefit per habitat unit, even though 6D would benefit more habitat units. Moreover, 2DS is more flexible than 6D as it allows for easier implementation of adaptive management to help resolve uncertainties. Specifically, only 6D would implement a large permanent structure to prevent groundwater flows into the C-111 Canal, which would have to be de-constructed if adaptive management monitoring determines a need. Alternative 6D would also not satisfy the important project constraint of accommodating low water levels for the Seaside Sparrow, while 2DS would regulate its pumping accordingly.

### Comments & Suggestions

Beyond the notable overall project benefits outlined above, we offer a few technical and editorial comments to improve the Final EIS (FEIS). Regarding technical issues, we recommend the following for the COE's consideration:

\* Water Quality – From a water quality perspective, we note that the project's generation of overland sheet flow should improve water quality when compared to current canal discharges into receiving water bodies. We are also pleased that a project objective is to moderate the hypersaline waters of Little Madera Bay, Joe Bay and Florida Bay to more historic levels associated with estuarine waters. Moreover, we note (pg. 7-14) that total phosphorus levels are predicted to be low (about 5 ppb, compared to the Settlement Agreement standard of 8 ppb) for Taylor Slough waters entering Florida Bay due to ongoing upstream efforts. Regarding chemical contaminants that may be released during the flooding of project areas and affecting water quality of downstream flows, the Frog Pond Detention Area may have the greatest potential for concern. However, page 7-27 indicates that "...scraping to remove the maximum practical amount of soil from the wetted surfaces of the FPDA [Frog Pond Detention Area] would be sufficiently protective of ecological receptors" and that "[a]ll other elements of Alternatives 1D, 2D Short and 2D Long are free of HTRW [hazardous, toxic and radioactive waste] and site contamination issues." In addition to these benefits, EPA requests additional FEIS discussion on any other water quality benefits provided by the project or that would incidentally result from the project (e.g., sponsor land acquisition, removing this land from farming and potential development).

\* Monitoring – Although project monitoring is referenced in the main document (e.g. Section 5.10.3 and 8.2.2), it is fully discussed in Annex E. While EPA finds this monitoring plan to be adequate overall, we offer the following comments:

+ *Figure E-2*: This figure is confusing and should be clarified in the FEIS to mesh with the accompanying Table E-1 and the discussion. On Figure E-2, the proposed structure S176B should be renamed to S-200, which is the 225 cfs intake pump to the 590-acre water detention basin (since there is no outlet structure, we note that all water

pumped into the detention basin will seep into the surficial aquifer). Also, proposed S177B on Figure E-2 needs to be renamed to S199.

+ *Summary*: We suggest that the main document provide a short summary of the monitoring proposed for the project as well as related issues such as the ecological performance standards to be used to determine project success. Also, what is the process for implementing adaptive management for the project in terms of the timeframe required before a change is authorized and initiated?

\* Environmental Justice (EJ) – Page 5-43 suggests that EJ populations would not be affected by the project and stated that “[s]takeholders meetings with the minority groups took place in 2003 to address concerns.” However, these public concerns were not disclosed or referenced. Accordingly, it is difficult for the public to determine the absence of an EJ effect without such discussion. In addition, such 2003 outreach is now somewhat dated information and may have changed. We also note that page 6-14 indicates that no relocation assistance would be needed or required. The FEIS should more clearly indicate if any residents or businesses would be displaced by the project and, if so, the demographics of those people to be relocated.

\* Invasive Species – Page 7-20 lists several non-native species such as *Melaleuca* that are present in the project area. The DEIS indicates (pg. 7-21) that “[a]ll of the alternatives include redistribution of freshwater into wetland communities that will retard the growth and spread of invasive, non-native plant species.” While this may be true for certain species, certain invasives such as Brazilian Pepper would thrive in such environments. Similarly, *Melaleuca* was presumably intentionally introduced to south Florida many years ago to help convert wetlands to uplands. The FEIS should discuss if the project will attempt to control invasive species on the 776 acres of private lands that are to be purchased since these lands would become fallow and available for opportunistic invasive species.

\* Cumulative Impacts – Cumulative impacts should discuss both negative and positive impacts. As a restoration project, the overall impact of CERP (and the present C-111 SC Western Project component) is positive. The discussion on page 7-32 should therefore be broadened in the FEIS to include the positive effects of other CERP projects relative to the subject C-111 SC Western Project. These include the prospective C-111 SC Eastern Project as well as the ongoing Modified Waters Delivery (MWD) Project and others intended to re-hydrate the Everglades and restore flows to Florida Bay.

Editorially, we suggest additional language for clarity in areas such as the following:

\* Barnes Sound Water Quality – Page 5-38 states that “...supplemental data from the environmental evaluation suggests that Alternative 6D would cause substantial damage to Barnes Sound.” However, the type and magnitude of this damage was not discussed or referenced. Based on Section 7, we note that such damage would be salinity related since 6D would still allow high flows through S-197 (pg. 7-16 and Table 7-2) and

discharges into Barnes Sound, which lowers ambient salinities at the outfall and impacts local marine inhabitants. We suggest that the said "damage" be briefly described (e.g., salinity reductions due to discharges) or that the Section 7 discussion be referenced.

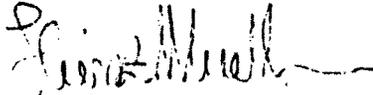
\* **Florida Bay Salinities** – Page 5-45 states that "...the benefit analysis indicates there could be a decline in salinity conditions for the eastern portions of the Florida Bay as more water is redistributed to the western portion of the project area." We suggest that "a decline in salinity conditions" be defined parenthetically or replaced with what we assume is intended to mean "an increase in the hypersalinity conditions".

**EPA DEIS Rating**

We rate this DEIS as an "LO" (Lack of Objections). EPA supports the C-111 SC Western Project. We believe that this project and its prospective Eastern Project counterpart should benefit the CERP recovery of the Everglades and Florida Bay.

EPA appreciates the opportunity to review the DEIS. Should you have questions regarding these comments, feel free to contact Chris Hoberg of my staff for NEPA issues (404-562-9619 or [hoberg.chris@epa.gov](mailto:hoberg.chris@epa.gov)) and Eric Hughes of the EPA Water Protection Division (located in the Jacksonville District office) for technical issues (904/232-2464 or [Eric.H.Hughes@usace.army](mailto:Eric.H.Hughes@usace.army)).

Sincerely,



Heinz J. Mueller, Chief  
NEPA Program Office  
Office of Policy and Management



## United States Department of the Interior

OFFICE OF THE SECRETARY  
Washington, D.C. 20240

March 7, 2011

Colonel Alfred A. Pantano, Jr.  
Commander  
United States Army Corps of Engineers  
Jacksonville District  
P.O. Box 4970  
Jacksonville, FL 32232-0019

Dear Colonel Pantano:

Thank you for the opportunity to review the *Final Integrated Project Implementation Report and Environmental Impact Statement* (FPIR/EIS) for the C-111 Spreader Canal Western Project dated January 2011. It is important that the C-111 Spreader Canal Western Project be ready for inclusion in the next Water Resources Development Act. This FPIR/EIS integrates the planning evaluation of the Federal project and the regulatory evaluation of the South Florida Water Management District's (SFWMD) proposed expedited project. The C-111 Spreader Canal Project, a priority for the Department of the Interior (Department), has been split into two separate, but related projects, the C-111 Spreader Canal Western Project and the C-111 Spreader Canal Eastern project. This project is the first of the two projects. The Department appreciates the efforts of the Corps and SFWMD staff in preparing this document and in addressing our comments on previous drafts.

The Department supports the Federal Recommended Plan set forth in the FPIR/EIS. The ecological health of Taylor Slough in Everglades National Park (ENP), South Dade Wetlands, and adjacent coastal ecosystems in Florida Bay has been in decline from the altered hydrology resulting from regional water management systems. Over 150,000 acres of freshwater wetlands are affected and approximately 130,000 acres of nearshore estuarine and bay areas have been impacted. It is anticipated that the C-111 Spreader Canal Western Project will reduce these impacts with improvements to hydropatterns in Taylor Slough and portions of the South Dade Wetlands.

In the Department's comment letter on the July 2009 *Final Project Implementation Report and Environmental Impact Statement for the C-111 Western Project*, the Department mentioned both features involving the discharge of nutrients from the surrounding agricultural farms and the fish farm and also features involving water quality. As we move forward with project

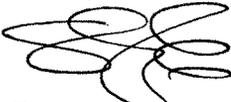
implementation, it will be important to monitor for any potential water quality effects to adjacent areas of ENP. Additionally, it is the understanding of the Department that if sampling during project implementation shows agricultural or aquaculture contaminants in the soils, those soils will be remediated. As we also mentioned in our earlier letter, the Department looks forward to working with your staff as the operational regime for this project is further developed.

The second project, the C-111 Spreader Canal Eastern Project, will mainly concentrate on environmental restoration in the Southern Glades and Model Lands. The Department supports moving ahead as soon as possible with the C-111 Spreader Canal Eastern Project. We request that the following recommendations be considered:

- The portion of the L-31W Canal below S-175 be backfilled and/or adequately plugged to ensure that the C-111 Spreader Canal detention areas function properly.
- Detention basins should minimize stage gradient differences between the detention basins and marshes in ENP. Marsh driven operations are a crucial component of the adaptive management program to achieve maximum ecological benefits and reduce deleterious nutrient enrichment effects in ENP.
- Supplying additional water sources to the project area will be critical to the next project, and must be included to reduce potential deleterious water recessions in the Panhandle wetlands. It is essential that these new water sources be identified and made available, with any needed water quality treatment, prior to the implementation of the next project phase to achieve maximum ecological benefits.

The Department looks forward to working with you and your staff to ensure that the highest level of project benefits is achieved with both the C-111 Spreader Canal Western Project and the future C-111 Spreader Canal Eastern Project.

Sincerely,

A handwritten signature in black ink, appearing to read "Shannon Estévez". The signature is stylized with several loops and a long tail that extends downwards.

Shannon Estévez  
Director, Everglades Restoration Initiatives

OFFICE OF AGRICULTURAL  
WATER POLICY  
(850) 617-1700



MAGNOLIA CENTER, SUITE 200  
1203 GOVERNOR'S SQUARE BOULEVARD  
TALLAHASSEE, FLORIDA 32301

FLORIDA DEPARTMENT OF AGRICULTURE AND CONSUMER SERVICES  
COMMISSIONER ADAM H. PUTNAM

---

March 10, 2011

Lauren P. Milligan  
Florida State Clearinghouse  
Florida Department of Environmental Protection  
3900 Commonwealth Blvd, M.S. 47  
Tallahassee, Florida

**RECEIVED**

MAR 11 2011

DEP Office of  
Intergov't Programs

Dear Ms. Milligan:

The Florida Department of Agriculture and Consumer Services (FDACS) appreciates the opportunity to provide comments on the Final Integrated Project Implementation Report and Environmental Impact Statement (PIR/EIS) For the C-111 Spreader Canal Western Project – Miami-Dade County, Florida dated January 2011. We are submitting the following comments for consideration as part of the Florida State Clearinghouse consistency evaluation.

We continue to be concerned that implementation of this project will result in negative impacts to privately owned agricultural lands in the vicinity of the project. Our concern is that a rise in groundwater elevations will result in root zone flooding that will be detrimental to crops. Because the recommended plan does not provide for the acquisition of private lands prior to project implementation, reasonable assurance needs to be provided that the level of service for flood protection will not be diminished in the vicinity of the project. As we have noted in previous comments on this project, such reasonable assurance is required by Florida law (Chapter 373.1501(5)(d), Florida Statutes). The project is likely to result in diminished levels of service for flood protection on private lands and consequently the Project is not in compliance with this statutory requirement.

Project plans to increase the operating level of the C-111 Canal between the S-177 and S-18C structures will result in higher groundwater levels and diminished flood protection on 776 acres of privately owned land. The PIR/EIS indicates that hydrologic changes on these 776 acres will be significant enough to require land acquisition. However, the PIR/EIS is equivocal regarding the acquisition of the 776 acres, stating that "SFWMD has agreed to acquire in fee privately owned lands which are jointly determined to be, or to have been, impacted by operation of the project." Because the SFWMD has not identified funds for acquiring these lands in the project planning process, it is critical to avoid negative consequences that could accompany an increase in groundwater levels on private agricultural properties.



Ms. Lauren P. Milligan  
March 10, 2011  
Page Two

We recognize that the PIR/EIS states the intention to avoid adverse impacts and appreciate that the permit for the project requires ongoing monitoring of any operational changes to ensure that adverse impacts do not occur. However, we are concerned that any adverse impacts will be identified after-the-fact, subject to a joint determination, and based upon criteria not specified in the PIR/EIS. Clearly there is some degree of uncertainty regarding such impacts and we are concerned that the risk associated with that uncertainty will be assumed by private property owners. We believe this approach provides something less than the reasonable assurance required under Chapter 373.1501(5)(d), Florida Statutes.

FDACS looks forward to the restoration success of the C-111 West Spreader Canal project and the ongoing viability of agriculture in south Florida. Thank you for the opportunity to comment on the Final Integrated Project Implementation Report and Environmental Impact Statement For the C-111 Spreader Canal Western Project – Miami-Dade County, Florida. If you have questions regarding FDACS' comments, please contact Ray Scott at (850) 617-1716 or Rebecca Elliott at (561) 682-6040.

Sincerely,

**ADAM H. PUTNAM**  
**COMMISSIONER**



Ray Scott  
Environmental Administrator

-----Original Message-----

From: Straw, William [mailto:William.Straw@dhs.gov]  
Sent: Wednesday, March 23, 2011 12:02 PM  
To: Bee, Patricia L HQ02  
Cc: Madson, Stephanie  
Subject: RE: CERP, C-111 Spreader Canal Project (UNCLASSIFIED): FEMA R4 11988 Reply

Ms. Bee: Good morning & thank you for writing.

I reviewed the "C-111 Spreader Canal Project" EIS documents linked below, including the project's purpose, location, design, operation, maintenance, floodplain management and flood insurance program (EIS Section 8.1.5), environmental, socioeconomic, and other aspects.

FEMA Region IV comments follow.

The project as designed and planned to be operated and maintained would overall reduce flood risks for developed properties and infrastructure, by redirecting more freshwater runoff into the undeveloped Florida Everglades, which were more frequently and more deeply flooded in the past.

If not already done, the applicable project representatives should coordinate with the "Floodplain Administrators" for each affected local jurisdiction, for their consideration of the project's likely flood risk changes, effects on their communities' ratings in the National Flood Insurance Program's "Community Rating System", effects on flood insurance policy holders' policy premiums, and for the Floodplain Administrators' approvals.

The local Floodplain Administrators' title may differ. They may be in Planning, Zoning, Public Works, or other local government office.

For any jurisdictions that do not have a Floodplain Administrator, the applicable project representatives should coordinate with the State Floodplain Management Coordinator for consideration and approval.

Under Presidential Executive Order (EO) 11988 (Floodplain Management), the lead federal agency involved would: (1) Go through the EO 11988 8-step project review process; (2) Make own their EO 11988 final determination; and (3) Keep a complete, legally binding record of their EO 11988 8-step process work, including copies of public notices and affected jurisdictions' Floodplain Management Administrators and/or the State Floodplain Management Coordinator (as described above).

For the determining agency's permanent, legal project records, this project's EO 11988 work may recorded be in a separate document, or appended to or integrated into another document for this project, with sufficient clarity and completeness to show that the full intent of EO

11988 was met. As required by the Federal Records Act of 1950 (as amended), these records will eventually be sent to the applicable federal archives (National Archives and Records Administration) office.

Thank you again for the opportunity to review and comment on this project.

Please contact me if we can help further.

Sincerely,

\*r

"William" R Straw, PhD  
Regional Environmental Officer  
& Regional EO 11988 Lead  
FEMA Region IV  
770-220-5432

-----Original Message-----

From: Bee, Patricia L HQ02 [<mailto:Patricia.L.Bee@usace.army.mil>]  
Sent: Tuesday, March 22, 2011 14:42  
To: Straw, William  
Cc: Madson, Stephanie  
Subject: RE: CERP, C-111 Spreader Canal Project (UNCLASSIFIED)  
Importance: High

Mr. Straw,

I would like to follow-up with you regarding the CERP, C-111 Spreader Canal Project, which was sent to your office for review on 1/28/11. Please let me know if there are any comments or recommendations that you would like to add to the report.

Please find below, a link to the C-111 Project.

[http://www.evergladesplan.org/pm/projects/docs\\_29\\_c111\\_pir.aspx](http://www.evergladesplan.org/pm/projects/docs_29_c111_pir.aspx)

Thank you,

Trish Bee  
HQ USACE, OWPR  
(202) 761-4701



## Florida Department of Environmental Protection

Marjory Stoneman Douglas Building  
3900 Commonwealth Boulevard  
Tallahassee, Florida 32399-3000

Rick Scott  
Governor

Jennifer Carroll  
Lt. Governor

Herschel T. Vinyard, Jr.  
Secretary

March 22, 2011

Mr. Theodore A. Brown, P.E.  
Chief, Planning and Policy Division  
Headquarters, CECW-P (SA)  
U. S. Army Corps of Engineers  
7701 Telegraph Road  
Alexandria, VA 22315-3860

RE: Department of the Army, Jacksonville District Corps of Engineers -  
Final Integrated Project Implementation Report and Environmental  
Impact Statement (PIR/EIS) for the C-111 Spreader Canal Western  
Project - Miami-Dade County, Florida.  
SAI # FL201101245616C (Reference prior SAI # FL200904304722C)

Dear Mr. Brown:

The Florida State Clearinghouse has coordinated a review of the Final Project Implementation Report and Environmental Impact Statement (PIR/EIS) under the following authorities: Presidential Executive Order 12372; Section 403.061(40), *Florida Statutes (F.S.)*; the Coastal Zone Management Act, 16 U.S.C. §§ 1451-1464, as amended; and the National Environmental Policy Act, 42 U.S.C. §§ 4321-4347, as amended.

The Florida Department of Environmental Protection (DEP) staff indicates that DEP's previous comments on the project appear to have been addressed in the Final PIR/EIS. The DEP continues to fully support moving the recommended plan Alternative 2DS forward for federal approval, funding and full implementation. A Comprehensive Everglades Restoration Plan Regulation Act (CERPRA) permit for project construction and operation was issued in accordance with Section 373.1502, *F.S.*, on October 8, 2009, and a final order formally approving the project under Sections 373.026 and 373.1501, *F.S.*, was issued to the South Florida Water Management District on December 1, 2009. As noted in its previous comments and the CERPRA permit, the DEP recommends continual refinement of the operation and monitoring plans to ensure that project benefits are achieved to the maximum extent practicable, while protecting and preventing private property from adverse impacts. DEP staff looks forward to completion of construction and project implementation. Should you have any questions on the comments provided, please feel free to contact Mr. Michael Willson at (850) 245-7534.

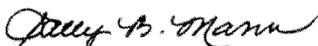
Mr. Theodore A. Brown, P.E.  
March 22, 2011  
Page 2 of 2

The Florida Department of Agriculture and Consumer Services (FDACS) continues to express concerns regarding the potential for negative impacts to privately owned agricultural properties from elevated groundwater levels, resulting in root zone flooding and crop failure. Because the recommended plan does not include funds for the purchase of private lands impacted by the project, reasonable assurance must be provided that the level of service for flood protection will not be diminished, in accordance with Section 373.1501 (5)(d), F.S. Due to the proposed increased operating level of the C-111 Canal between the S-177 and S-18C structures and higher groundwater levels on 776 acres of privately owned land, FDACS states that the project is not in compliance with this statutory requirement. Although the PIR/EIS indicates that hydrologic changes on these 776 acres will be significant enough to require land acquisition, any adverse impacts will be identified after-the-fact, impacts are subject to an unspecified joint determination and funds have not been identified to acquire these lands. The uncertainty and private landowner risk associated with these potential impacts does not appear to provide the reasonable assurance required under Section 373.1501(5)(d), F.S. Please refer to the enclosed FDACS letter for further details.

Based on the information contained in the Final PIR/EIS and enclosed state agency comments, the state has determined that the proposed activities are consistent with the Florida Coastal Management Program (FCMP). The state's continued concurrence will be based on the activity's compliance with FCMP authorities, including federal and state monitoring of the activity to ensure its continued conformance, and the adequate resolution of issues identified during this and any subsequent reviews. The state's final concurrence of the project's consistency with the FCMP was determined during the environmental permitting process under Section 373.428, F.S.

Thank you for the opportunity to review the subject document. Should you have any questions regarding this letter, please contact Mr. Chris Stahl at (850) 245-2169.

Yours sincerely,



Sally B. Mann, Director  
Office of Intergovernmental Programs

SBM/cjs  
Enclosures

cc: Brad Tarr, USACE, Jacksonville District  
John Outland, DEP, Ecosystem Projects  
Ernie Marks, DEP, Everglades RPPS  
Dianne Hughes, DEP, Southeast District  
W. Ray Scott, FDACS



# Florida

## Department of Environmental Protection

"More Protection, Less Process"



Categories

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Project Information	
<b>Project:</b>	FL201101245616C
<b>Comments Due:</b>	03/03/2011
<b>Letter Due:</b>	03/25/2011
<b>Description:</b>	DEPARTMENT OF THE ARMY, JACKSONVILLE DISTRICT CORPS OF ENGINEERS - FINAL INTEGRATED PROJECT IMPLEMENTATION REPORT AND ENVIRONMENTAL IMPACT STATEMENT (PIR/EIS) FOR THE C-111 SPREADER CANAL WESTERN PROJECT - MIAMI-DADE COUNTY, FLORIDA.
<b>Keywords:</b>	ACOE - FIPIR/EIS, C-111 SPREADER CANAL WESTERN PROJECT - MIAMI-DADE CO.
<b>CFDA #:</b>	12.106
Agency Comments:	
<b>AGRICULTURE - FLORIDA DEPARTMENT OF AGRICULTURE AND CONSUMER SERVICES</b>	
<p>The FDACS continues to express concerns regarding the potential for negative impacts to privately owned agricultural properties from elevated groundwater levels, resulting in root zone flooding and crop failure. Because the recommended plan does not include funds for the purchase of private lands impacted by the project, reasonable assurance must be provided that the level of service for flood protection will not be diminished, in accordance with Section 373.1501(5)(d), F.S. Due to the proposed increased operating level of the C-111 Canal between the S-177 and S-18C structures and higher groundwater levels on 776 acres of privately owned land, FDACS states that the project is not in compliance with this statutory requirement. Although the PIR/EIS indicates that hydrologic changes on these 776 acres will be significant enough to require land acquisition, any adverse impacts will be identified after-the-fact, impacts are subject to an unspecified joint determination and funds have not been identified to acquire these lands. The uncertainty and private landowner risk associated with these potential impacts does not appear to provide the reasonable assurance required under Section 373.1501(5)(d), F.S.</p>	
<b>FISH AND WILDLIFE COMMISSION - FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION</b>	
NO COMMENT BY DAN CASTILLO ON 3/1/11.	
<b>TRANSPORTATION - FLORIDA DEPARTMENT OF TRANSPORTATION</b>	
The Florida Department of Transportation has reviewed the above referenced project and has no comments.	
<b>ENVIRONMENTAL PROTECTION - FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION</b>	
<p>DEP staff indicates that DEP's previous comments on the project appear to have been addressed in the Final PIR/EIS. The DEP continues to fully support moving the recommended plan Alternative 2DS forward for federal approval, funding and full implementation. A Comprehensive Everglades Restoration Plan Regulation Act (CERPRA) permit for project construction and operation was issued in accordance with Section 373.1502, F.S., on October 8, 2009, and a final order formally approving the project under Sections 373.026 and 373.1501, F.S., was issued to the South Florida Water Management District on December 1, 2009. As noted in its previous comments and the CERPRA permit, the DEP recommends continual refinement of the operation and monitoring plans to ensure that project benefits are achieved to the maximum extent practicable, while protecting and preventing private property from adverse impacts. DEP staff looks forward to completion of construction and project implementation. Should you have any questions on the comments provided, please feel free to contact Mr. Michael Wilson at (850) 245-7534.</p>	
<b>SOUTH FLORIDA WMD - SOUTH FLORIDA WATER MANAGEMENT DISTRICT</b>	
The District is a partner with the Corps in this project. Consequently, a consistency determination is not necessary.	

For more information or to submit comments, please contact the Clearinghouse Office at:

3900 COMMONWEALTH BOULEVARD, M.S. 47  
 TALLAHASSEE, FLORIDA 32399-3000  
 TELEPHONE: (850) 245-2161



## Memorandum

---

TO: Florida State Clearinghouse

THROUGH: Greg Knecht, Director  
Office of Ecosystem Projects

FROM: Inger Hansen, Stacey Feken

DATE: March 4, 2011

SUBJECT: USACE - Final Integrated Project Implementation Report and  
Environmental Impact Statement (PIR/EIS) for the C-111 Spreader Canal  
Western Project - Miami-Dade County, Florida.

SAI #: FL11-5616C (Reference previous SAI # FL09-4722C)

### **Background:**

In January of 2011, the Jacksonville District of the U.S. Army Corps of Engineers (USACE) published the Final Project Implementation Report and Environmental Impact Statement (Final PIR/EIS) for the Central and South Florida Project (C&SF), Comprehensive Everglades Restoration Plan (CERP) C-111 Spreader Canal Western Project. A Request for Department comments was received through the State Clearinghouse on January 27, 2011. The C-111 Spreader Canal Project is being implemented in two phases through two separate PIRs and the currently proposed C-111 Spreader Canal Western Project PIR is the first of the two planned phases.

The C-111 Spreader Canal Project was one of the ten initial projects authorized as a component of CERP under the Water Resources Development Act (WRDA) of 2000. The primary restoration purpose for the C-111 Spreader Canal Project identified in the Plan was to improve water deliveries and enhance connectivity and sheetflow in the Model Lands and Southern Glades areas, reduce wet season flows in the C-111, and decrease potential flood risk in the southern Miami-Dade County area.

### **Comments:**

The Department provided comments on the C-111 Spreader Canal Western Project Draft PIR/EIS on June 12, 2009, and the Final EIS on August 12, 2009. We have reviewed the Final PIR/EIS, dated January 2011, and found that our previous comments appear to have been addressed.

Florida State Clearinghouse  
Final PIR/EIS for the for the C-111 Spreader Canal Western Project  
March 4, 2011  
Page 2 of 2

The Department continues to fully support moving the recommended plan Alternative 2DS forward for federal approval, funding and full implementation. We issued a Comprehensive Everglades Restoration Plan Regulation Act (CERPRA) permit for construction and operations of the project pursuant to Section 373.1502, Florida Statutes (F.S.), on October 8, 2009, and a final order formally approving the project in accordance with the requirements set forth in Sections 373.026 and 373.1501, F.S., to the South Florida Water Management District on December 1, 2009.

As noted in our previous comments and the CERPRA permit, the Department recommends continual refinement of the operation and monitoring plans to ensure that project benefits are achieved to the maximum extent practicable, while protecting and preventing private property from adverse impacts.

The Department looks forward to completion of construction and project implementation. Should you have any questions on the comments provided, please feel free to contact Michael Willson at (850) 245-7534.

**Electronic copies to:**

John Outland  
Inger Hansen  
Ernie Marks  
Stacey Feken  
Dianne Hughes  
Tracy Robb  
Deirna Nicholson  
Michael Willson



DEPARTMENT OF THE ARMY  
U.S. ARMY CORPS OF ENGINEERS  
441 G STREET NW  
WASHINGTON, D.C. 20314-1000

Planning and Policy Division

29 JUL 2011

William R. Straw, PhD  
Regional Environmental Officer  
and Regional EO 11988 Lead  
Federal Emergency Management Agency, Region IV  
3003 Chamblee Tucker Road  
Atlanta, GA 30341

Dear Mr. Straw:

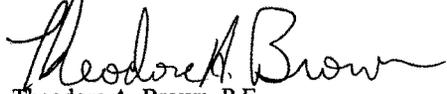
Thank you for your electronic correspondence dated March 23, 2011 regarding the C-111 Spreader Canal Western Project Final Project Implementation Report and Environmental Impact Statement (PIR/EIS). The proposed project has also been coordinated with the Miami-Dade Department of Environmental Resources Management (DERM), the Floodplain Administrator for the affected local jurisdiction. Additionally, Miami-Dade DERM representatives were active members of the Project Delivery Team that developed the C-111 Spreader Canal Western Project.

Executive Order 11988 directs Federal agencies to "avoid to the extent possible the long and short term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct or indirect support of floodplain development wherever there is a practicable alternative." As discussed in the Final PIR/EIS, the potential effects of the proposed C-111 Spreader Canal Western Project have been evaluated and alternatives to avoid adverse effects have been considered, including actions affecting floodplains. Complete avoidance of activities within the floodplain is not practical because an objective of this project is the improvement of hydropatterns and hydroperiods within the floodplain areas for ecosystem restoration of the Everglades. As you may be aware, the potential for development opportunities within the floodplain would actually decrease as a result of the proposed project due to the ecosystem restoration components and necessary acquisition of land for project features. All appropriate and necessary action was taken to minimize potential harm to or within the floodplain in accordance with Section 2(d) of the Executive Order. No short or long term adverse impacts associated with the occupancy or modification of floodplains would occur as a result of the proposed project.

A public notice describing possible effects within the floodplain has been circulated to adjacent property owners and any party that might be affected as a result of the proposed project. All comments that were received as a result of the public coordination have been addressed and are included as part of the Final PIR/EIS. As such, the proposed project complies with Executive Order 11988, including the multi-step decision-making process required in Section 2(a).

We trust that the above information sufficiently addresses your concerns. If you would like to discuss these issues further, please contact Ms. Jeanette Gallihugh, HQUSACE, at (202) 761-0668.

Sincerely,

A handwritten signature in black ink that reads "Theodore A. Brown". The signature is fluid and cursive, with the first name being the most prominent.

Theodore A. Brown, P.E.  
Chief, Planning and Policy Division  
Directorate of Civil Works



DEPARTMENT OF THE ARMY  
U.S. ARMY CORPS OF ENGINEERS  
441 G STREET NW  
WASHINGTON, D.C. 20314-1000

Planning and Policy Division

29 JUL 2011

Adam H. Putnam, Commissioner  
Florida Department of Agriculture and Consumer Services  
Magnolia Center, Suite 200  
1203 Governor's Square Boulevard  
Tallahassee, Florida 32301

Dear Commissioner Putnam:

Thank you for your letter dated March 10, 2011 on the C-111 Spreader Canal Western Project Final Project Implementation Report (PIR). The letter expressed concerns regarding the potential for negative impacts to privately owned agricultural properties from elevated groundwater levels and that levels of service for flood protection would be diminished. Additionally, the letter expressed concerns that adverse impacts will be identified after-the-fact, impacts are subject to an unspecified joint determination and funds have not been identified to acquire these lands. We appreciate your staff's willingness to identify issues of concern and offer the following information and explanations in response to your letter.

The Water Resources Development Act (WRDA) of 2000 requires that implementation of the Comprehensive Everglades Restoration Plan (CERP) shall not reduce existing levels of service for flood protection. The PIR indicates that approximately 776 acres of privately owned lands may be affected by the project.

As you may be aware, the South Florida Water Management District (SFWMD) as part of its expedited construction program is constructing portions of the C-111 Spreader Canal Western project that are intended to be consistent with the recommended plan. However, Federal participation is dependent upon a number of factors such as authorization from Congress and execution of a Project Partnership Agreement. The SFWMD has indicated that it wants to monitor the impacts of the current construction and present additional information to the Corps regarding reduction or elimination of potential flooding effects.

The Corps is willing to take into account this information and reassess its takings analysis and whether the project will reduce the existing levels of service for flood protection on the 776 acres or a portion thereof. The Corps is willing to reassess this information because the current analysis is based upon a model, and like many models, it encompasses certain assumptions and has a degree of uncertainty. Additional information may help to refine the assumptions and decrease uncertainty. Please see Section A.10.2.1.2 of Appendix A of the PIR for a discussion of the modeling uncertainties. If, based on the new information provided by the SFWMD, it is determined that a property will not be affected by the authorized Federal project, it may no longer be necessary to acquire an interest in that particular property or properties. The new information

must also document that operational adjustments implemented to avoid a reduction of the level of service for flood protection on that particular property or properties can also provide the anticipated ecological benefits.

The reassessment will utilize a method similar to the original method of determination of affects on existing levels of service for flood protection (Section D.13 of Appendix D of the PIR). Like the analysis in the PIR, the re-assessment will be conducted in a manner consistent with the CERP Programmatic Regulations and guidance. In addition, the takings analysis will be similarly reassessed. If the new information documents that operational adjustments can avoid these impacts to private property, the operational adjustments will be made permanent and incorporated into the Final Project Operating Manual for the authorized Federal project. Otherwise, the SFWMD will acquire the necessary interests in the lands. This process allows the Corps to take into account additional information and update its determination regarding flood service protection. The Corps' will revise the current project documentation to clarify this position.

Florida Statutes Section 373.1501 (5)(d) states that the SFWMD shall "provide reasonable assurances ... that existing levels of service for flood protection will not be diminished outside the geographic area of the project component, and that water management practices will continue to adapt to meet the needs of the restored natural environment." The SFWMD, in its June 30, 2009 State Compliance Report addressed reasonable assurances under State law. See page 71. This report was included in Annex C of the PIR. SFWMD has indicated that once construction is complete, SFWMD will monitor sentinel wells constructed for protection of the 776 acres, and operations will be continuously adjusted to prevent reductions in existing levels of flood protection.

We trust that the above information sufficiently addresses your concerns. If you would like to discuss these issues further, please contact Ms. Jeanette Gallihugh, HQUSACE, at (202) 761-0668.

Sincerely,

  
Theodore A. Brown, P.E.  
Chief, Planning and Policy Division  
Directorate of Civil Works



EXECUTIVE OFFICE OF THE PRESIDENT  
OFFICE OF MANAGEMENT AND BUDGET  
WASHINGTON, D.C. 20503

July 5, 2012

The Honorable Jo-Ellen Darcy  
Assistant Secretary of the Army (Civil Works)  
108 Army Pentagon  
Washington, D.C. 20310-0108

Dear Ms. Darcy:

As required by Executive Order 12322, the Office of Management and Budget have completed its review of an Army Corps of Engineers' proposal for the C-111 Spreader Canal Western ecosystem restoration project, Central and Southern Florida Project, Comprehensive Everglades Restoration Plan, Florida. Based on our review, we conclude that your recommendation for authorization of construction of this project is consistent with the policy and programs of the President.

The Office of Management and Budget does not object to your submitting the report to Congress for authorization. When you do so, please advise the Congress that should the Congress authorize the project, the project would need to compete with other proposed investments in future budgets.

Sincerely,

A handwritten signature in black ink, appearing to read "Richard A. Mertens".

Richard A. Mertens  
Deputy Associate Director  
Energy, Science and Water Division

**CENTRAL AND SOUTHERN FLORIDA PROJECT  
COMPREHENSIVE EVERGLADES RESTORATION PLAN  
C-111 SPREADER CANAL WESTERN PROJECT**

**FINAL INTEGRATED  
PROJECT IMPLEMENTATION REPORT AND  
ENVIRONMENTAL IMPACT STATEMENT**



Volume 1 – Main Report

January 2011



**US Army Corps  
of Engineers®**

U.S. ARMY CORPS OF ENGINEERS  
JACKSONVILLE DISTRICT



SOUTH FLORIDA WATER  
MANAGEMENT DISTRICT

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**CENTRAL AND SOUTHERN FLORIDA PROJECT  
C-111 SPREADER CANAL WESTERN PROJECT**

**FINAL PROJECT IMPLEMENTATION REPORT  
AND  
ENVIRONMENTAL IMPACT STATEMENT**



**US Army Corps  
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U.S. ARMY CORPS OF ENGINEERS  
JACKSONVILLE DISTRICT



SOUTH FLORIDA WATER  
MANAGEMENT DISTRICT

January 2011

**CENTRAL AND SOUTHERN FLORIDA PROJECT  
COMPREHENSIVE EVERGLADES RESTORATION PLAN (CERP)**

**C-111 SPREADER CANAL WESTERN PROJECT  
FINAL PROJECT IMPLEMENTATION REPORT  
AND  
ENVIRONMENTAL IMPACT STATEMENT**

**Responsible Agencies:** The lead agency is the U.S. Army Corps of Engineers, Jacksonville District. The South Florida Water Management District is the non-Federal cost-sharing partner for the project. Other participating agencies are the U.S. Fish and Wildlife Service, the U.S. Environmental Protection Agency, the National Park Service, the Florida Fish and Wildlife Conservation Commission, the U.S. Geological Survey, the Miami-Dade Department of Environmental Resources Management, the Natural Resources Conservation Service, and the Florida Department of Environmental Protection. The U.S. Fish and Wildlife Service, Florida Department of Environmental Protection, Everglades National Park, U.S. Environmental Protection Agency, the U.S. National Marine Fisheries Service, the U.S. Geological Survey, the Miami-Dade Department of Environmental Resources Management, and Florida Fish and Wildlife Conservation Commission all declined a formal invitation to become cooperating agencies for this environmental impact statement (EIS).

**Abstract:** This Final Project Implementation Report documents the study for the C-111 Spreader Canal Western Project, in accordance with the requirements of Section 601(d) of the Water Resources Development Act of 2000 and recommends authorization of the Project. The Project addresses the need to restore ecosystem function in Taylor Slough and Florida Bay within the Everglades National Park, the adjacent Southern Glades, the Model Land, and other associated wetlands and estuarine systems.

The C-111 Spreader Canal Western Project is essential to achieving the restoration of Taylor Slough and downstream, affected areas in Florida Bay, Everglades National Park, the Model Lands and the Southern Glades areas, and also plays an integral role in meeting the CERP system-wide ecosystem restoration goals and objectives. The Frog Pond Detention Area and Aerojet Canal facility will work in unison to create a hydraulic ridge just east of Everglades National Park. The hydraulic ridge will decrease seepage out of the Park, thereby improving the quantity, timing, and distribution (QTD) of water delivered to Florida Bay via Taylor Slough. Hydroperiods and hydropatterns within the wetlands of the Southern Glades and Model Lands will be improved by the construction of a new operable water control structure in the lower C-111 Canal, incremental operational changes at existing structure S-18C, changes in operations at the existing S-20 structure, construction of a plug at existing structure S-20A, and the installation of ten earthen plugs in the C-110 Canal. The features of the proposed project will also serve to return salinities to more natural levels in portions of Florida Bay and its associated estuaries.

This Final Project Implementation Report and Environmental Impact Statement describes public and agency involvement in Project development, explains the plan formulation, evaluation, and selection process, and documents the Recommended Plan features, including costs and environmental benefits.

THE OFFICIAL CLOSING DATE FOR THE RECEIPT OF COMMENT IS 45 DAYS FROM THE DATE ON WHICH THE NOTICE OF AVAILABILITY OF THIS EIS APPEARS IN THE FEDERAL REGISTER.

If you require further information on this document, contact:  
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NOTE: This report includes an integrated Final Environmental Impact Statement within the Final Project Implementation Report. An asterisk in the Table of Contents notes sections required for compliance with the National Environmental Policy Act.

## FOREWORD

### **A note to the reader of this Final PIR/EIS**

The State of Florida has a state expedited project program for the purpose of expediting design and construction of a number of critical restoration projects consistent with the Comprehensive Everglades Restoration Plan (CERP) but prior to one or more of the following: Administration approval, congressional committee resolution, congressional authorization, or Federal construction funding. The State anticipates the program will provide immediate environmental, social, and economic benefits in the South Florida region. All state expedited projects must be specifically authorized by Congress before becoming a part of the Federal CERP. The South Florida Water Management District (SFWMD) is the state agency responsible for water resources management in south Florida and acts as the non-Federal sponsor for Federal water resources projects, including CERP. The SFWMD is also the lead agency for the State on implementing the state expedited project and will need to acquire a Department of the Army permit under Section 404 of the Clean Water Act prior to construction.

The SFWMD has proposed to construct the C-111 Spreader Canal Western project prior to implementation of the Federal C-111 Spreader Canal Western project. The USACE is proceeding with two separate and independent but related actions, the planning evaluation of the Federal project and the regulatory evaluation of the SFWMD's proposed project both of which are described in this Final PIR/EIS. The SFWMD's C-111 Spreader Canal Western project per the permit application is the same as the NEPA preferred alternative or Federal Recommended Plan, as described in this Final PIR/EIS. The project purposes of the Federal Recommended Plan identified in this Final PIR and the SFWMD's project are consistent. This Final PIR/EIS served the basis for the Regulatory Division's NEPA evaluation of the SFWMD's proposed project. The Regulatory Division of the USACE has issued a Final EIS after an evaluation of the SFWMD permit application and proposal. The Final EIS is available for viewing at the following website:

<http://www.saj.usace.army.mil/Divisions/Regulatory/interest.htm>.

This Final PIR/EIS is posted on the CERP website:

<http://www.evergladesplan.org>.

CENTRAL AND SOUTHERN FLORIDA PROJECT  
COMPREHENSIVE EVERGLADES RESTORATION PLAN  
C-111 SPREADER CANAL WESTERN

FINAL INTEGRATED  
PROJECT IMPLEMENTATION REPORT  
AND  
ENVIRONMENTAL IMPACT STATEMENT

EXECUTIVE SUMMARY

The U.S. Army Corps of Engineers (USACE), Jacksonville District in cooperation with its co-sponsor, the South Florida Water Management District (SFWMD), has completed a Final Project Implementation Report (PIR) and Environmental Impact Statement (EIS) for the C-111 Spreader Canal (C-111 SC) Western project in Miami-Dade County. This final report describes the purpose and need, location, recommended plan and other alternatives considered. It also includes the data that was collected and generated, analyses, and evaluations made with regards to the alternatives that were formulated leading to the selection of a recommended plan for implementation. This report integrates plan formulation with documentation of environmental effects. It serves to satisfy documentation requirements of the National Environmental Policy Act of 1969, as amended (NEPA). This final report will be circulated for comment in accordance with National Environmental Policy Act (NEPA) review processes. A Chief of Engineer's report will be prepared based on the Final PIR.

PURPOSE AND NEED FOR THE STUDY

In 1999, the USACE completed the Central and Southern Florida (C&SF) Project Comprehensive Review Study (Restudy). The purpose of the Restudy was to re-examine the C&SF project to "determine the feasibility of structural or operational modifications to the project essential to the restoration of the Everglades and the south Florida ecosystem, while providing for other water related needs such as urban and agricultural water supply and flood protection in those areas served by the project (WRDA, 1996)." The intent of the study was to evaluate conditions within the south Florida ecosystem and make recommendations to modify the C&SF project to restore important functions and values of the Everglades and south Florida ecosystem and plan for the water resource needs of the people of south Florida for the next 50 years. The selected plan (Alternative D13-R) was published as the "Final Integrated Feasibility Report and Programmatic Environmental Impact Statement (PEIS) for the C&SF project", dated April 1999. The selected plan was approved by Water

Resources Development Act (WRDA) 2000 as the Comprehensive Everglades Restoration Plan (CERP).

The primary restoration purpose for the C-111 SC project identified in the CERP was:

“To improve deliveries and enhance the connectivity and sheetflow in the Model Lands and Southern Glades areas, reduce wet season flows in the C-111 Canal, and decrease potential flood risk in the lower south Miami-Dade County area.”

The C-111 Canal is the southernmost canal of the C&SF Flood Control project and is located in south Miami-Dade County. The C-111 Canal courses through extensive marl wetland prairie and coastal mangrove marsh before it empties into Manatee Bay. The canal serves a basin of approximately 100 square miles and functions primarily to provide flood protection and drainage for the agricultural areas to the west and south of Homestead, Florida. The canal is the final segment of the South Dade Conveyance System and provides a means to deliver water to Taylor Slough in Everglades National Park and the eastern Panhandle. Taylor Slough is a natural drainage feature of the Everglades that flows southwest into numerous tributaries that eventually empty into Florida Bay.

In addition to Everglades National Park, the C-111 SC project study area (*FIGURE ES-1*) includes the Model Land and the Southern Glades. The Model Land and Southern Glades areas form a contiguous habitat corridor with Everglades National Park, Biscayne National Park, Crocodile Lakes National Wildlife Refuge, the north Key Largo Conservation and Recreational Lands (CARL) purchases, John Pennekamp State Park, and the existing National Marine Sanctuary.

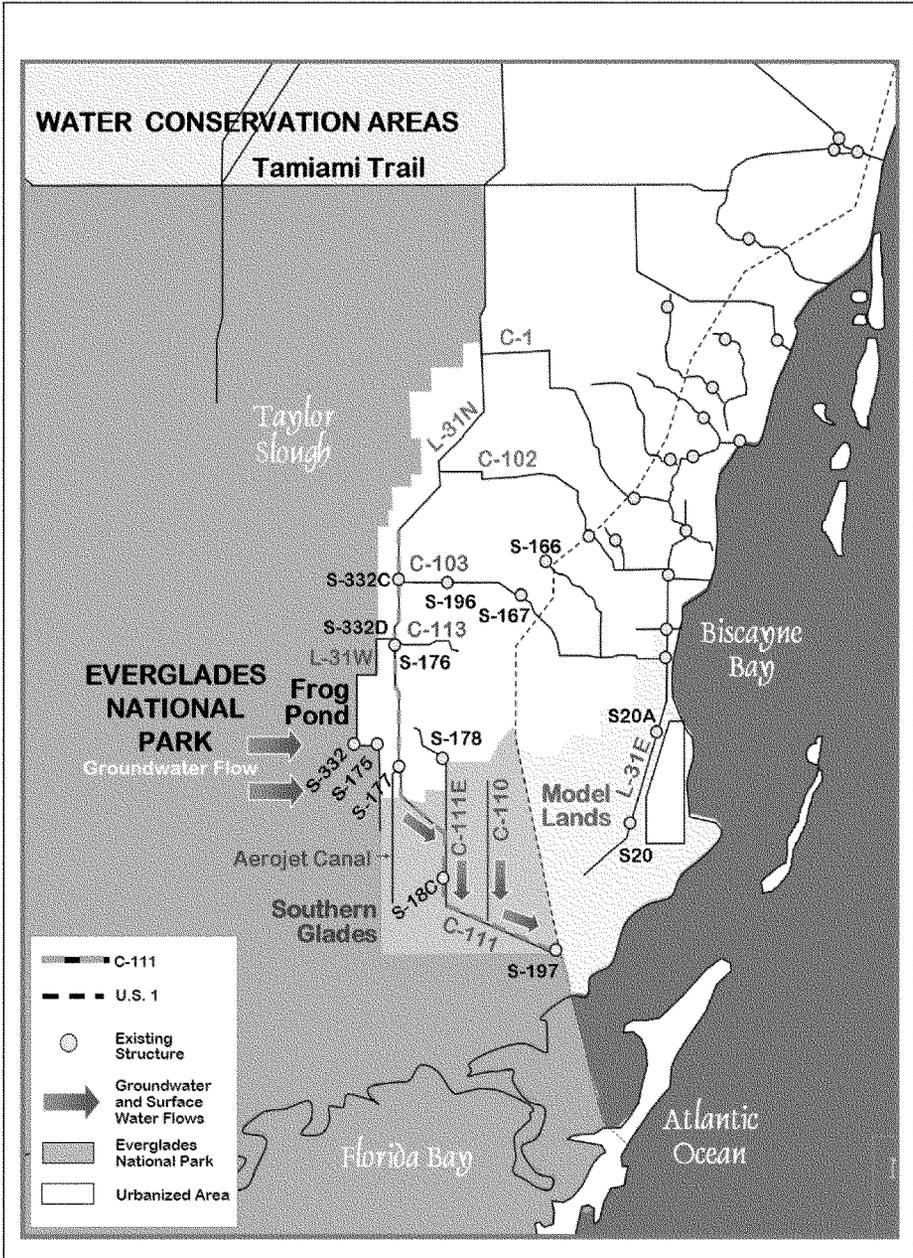


FIGURE ES-1: PROJECT LOCATION MAP

## WHAT WILL HAPPEN WITHOUT THE PROJECT?

Since the construction of the C&SF project, the ecological function of the study area in Everglades National Park and the associated southeastern Everglades has been in decline. The construction of the numerous drainage features has severely disrupted the hydrologic regime of the area, causing a transition from a wetland system characterized by overland sheetflow to one that moves water swiftly through conveyance features to point source discharge areas along Florida Bay.

Declines in ecological function of the Everglades have been well documented. The deteriorating conditions in the proposed project area illustrate these declines. The altered hydroperiods of the area have led to declines in prey bases for numerous macrofauna including migratory birds. Untimely marsh dryouts deplete populations of fish and amphibians that are necessary to sustain the massive colonies of birds that used to inhabit the area. Fires that once would have contributed to maintenance of the ecosystem now serve only to burn off layers of organic material and detritus that are imperative to maintaining proper nutrient levels. The resulting soil subsidence severely alters the composition of plant species in the natural communities, increasing the likelihood of invasion by aggressive, exotic vegetation.

The changes in the hydrology of the freshwater systems have also led to secondary effects on the estuarine and marine environments of Florida Bay. Damaging freshwater pulses from the C-111 Canal and tributaries disrupt flow patterns into Florida Bay and create an unnatural salinity envelope along the shorelines and further into the Bay. These salinity changes have drastic negative effects on nursery areas for fish and invertebrate species.

The disturbing trends in the Everglades will continue to worsen if the problems are not confronted. The effects that are occurring will not only be seen through the loss of aquatic-dependent wildlife; significant adverse impacts to commercial, recreational, and other economic activities are already occurring and will increase in intensity. Without action to reverse the effects of man-made alterations to the natural system of the Everglades, the environmental degradation will continue to occur. The complete ecological collapse of communities could become a reality, and a national treasure may be irreversibly harmed.

## ALTERNATIVES BEING CONSIDERED

The plan formulation and evaluation process involves identifying, organizing, and combining management measures to create different alternative plans for the project. The C-111 SC Western Project Delivery Team (PDT) utilized the Comprehensive Review Study alternative as a starting point for the basis of

developing alternatives. Alternatives were developed at a conceptual level while considering the overall goals, objectives, and constraints of the project. A total of 22 conceptual alternatives were formulated for the Initial Array.

#### INCREMENTAL ADAPTIVE RESTORATION AND STAKEHOLDER CONCERNS

After an evaluation of the Initial Array of Alternatives, the Department of the Interior as well as members of the public raised concerns regarding Taylor Slough and subsequent flows to Florida Bay. Additionally, Decision Critical Uncertainties were identified that could substantially affect plan selection and performance. As such, a decision was made to formulate and evaluate the C-111 Spreader Canal project as two separate projects, the first being the Western Project and the second being the Eastern Project. The Western Project focuses on the restoration of flows to Florida Bay via Taylor Slough as well as the restoration of the Southern Glades and Model Lands and coastal zone of Florida Bay. Due to numerous uncertainties associated with the actual spreader canal feature, a Spreader Canal Design Test will be implemented to gain information that will guide planning efforts for the Eastern Project. The Eastern Project will address the restoration of the remainder of the project area through such features as a spreader canal, backfilling of the C-111 Canal, etc.

#### INITIAL ARRAY OF ALTERNATIVES

An Initial Array of Alternatives was formulated by the project team for the Western PIR. The Alternative plans were modeled and a screening effort was conducted to eliminate alternatives that were not feasible or would clearly not meet the project objectives. Additionally, after an optimization effort was conducted, the remaining alternatives were grouped to form the Final Array. The Final Array of Alternatives is listed and described below:

#### FINAL ARRAY OF ALTERNATIVES AND PLAN COMPARISON

Refined operational criteria were developed and incorporated into a hydrologic modeling analysis for the Final Array of Alternatives. Using performance measure indices developed by the project team and approved by RECOVER, ecosystem restoration benefits were calculated for each alternative, including the No-Action Alternative (RECOVER comments are located in *ANNEX F*). A Cost Effectiveness/Incremental Cost Analysis was also performed to enable comparison of the Alternative plans. Additional criteria that were considered in the comparison included project objectives and constraints, as well as the criteria contained in the “Principles and Guidelines” for water resourced planning adopted by the Water Resources Council.

## MAJOR FINDINGS AND CONCLUSIONS

Alternative 2DS, the Recommended Plan, was identified as the NER plan, and is both Cost Effective and a Best Buy. Alternative 2DS meets the project objectives, and would have minimal negative effects. The Recommended Plan also meets the principles and guidelines (P&G) criteria of efficiency, effectiveness, completeness, and acceptability. As such, Alternative 2DS was determined to be in the national interest and can be constructed while protecting the human environment from unacceptable impacts

Implementation of the recommended plan or other action alternatives is expected to result in a degree of unavoidable adverse impacts. Specifically, increased water levels will result in an alteration of agricultural requirements in the Frog Pond area; and some existing wetlands would be permanently altered by the construction and excavation of project features. These impacts, however, would be offset by restoring and rehydrating a larger extent of freshwater and coastal wetlands.

## RECOMMENDED PLAN ELEMENTS

The C-111 SC Western Project Recommended Plan is Alternative 2DS and includes the following features:

- Frog Pond Detention Area
- Aerojet Canal
- One New Operable Structure in the Lower C-111 Canal
- Incremental Operational Changes at S-18C
- One Plug at S-20A
- Operational Changes at Existing Structure S-20
- Ten Plugs in the C-110 Canal
- Recreational Components
- Project Monitoring Plan
- Draft Project Operating Manual
- Operations, Maintenance, Repair, Rehabilitation, and Replacement (OMRR&R)

The Frog Pond Detention Area (FPDA) and Aerojet Canal feature are intended to work in unison to create an approximately nine-mile hydraulic ridge adjacent to Everglades National Park. The ridge will serve to block groundwater flows from moving into the C-111 Canal from Everglades National Park, therefore retaining water in Taylor Slough and improving the quantity, timing, and distribution of flows into Florida Bay. The remaining features of the Recommended Plan will serve to provide a jumpstart to environmental restoration in the Southern Glades and Model Land.

### FROG POND DETENTION AREA

The FPDA includes a 225 cubic feet per second (cfs) pump station, to be constructed downstream of the existing S-176 structure, that will route water which would otherwise be discharged down the lower C-111 Canal via S-177. The water will be routed to an approximately 590-acre above-ground detention area to be constructed within the southern portion of the SFWMD owned Frog Pond lands.

The 590-acre detention area will include a cascading header canal that will stage up approximately two and a half feet above existing ground before “feeding” the three cells which will make up the detention area. Weirs will be constructed between the header canal and receiving cell to ensure that the header stage meaningfully rises prior to discharging to the reservoir cells. The header cell will be fed by a lined conveyance channel located along the northern edge of the reservoir. The 225-cfs pump station will consist of three 75-cfs pumps to allow stepped operations. Pumping will be discontinued to prevent flooding if the elevation of the header canal exceeds two and a half feet above the existing ground. Pumping will also cease if ponding within the Cape Sable seaside sparrow (CSSS) Sub-population C area reaches a depth of ten centimeters during the nesting season, as measured at a pre-determined representative location.

### AEROJET CANAL

A second 225-cfs pump station will be constructed immediately upstream of the existing S-177 structure and downstream of State Road 9336. The pump station will work in tandem with and mirror the Frog Pond Detention Area pump operations, and will route water to the Aerojet Canal via a northerly extension of the canal. Pumping will be discontinued if the elevation of the canal exceeds two and a half feet above existing ground. Pumping will also cease if ponding within the CSSS Sub-population D area reaches a depth of ten centimeters, as measured at a pre-determined representative location.

### ONE OPERABLE STRUCTURE IN THE LOWER C-111 CANAL

The plan also includes the construction of an operable structure within the lower C-111 Canal. The proposed structure is intended to create groundwater mounding, thereby reducing current levels of seepage from the lower C-111 Canal while preserving existing levels of flood damage reduction.

### INCREMENTAL OPERATIONAL CHANGES AT S-18C

In order to maximize restoration opportunities, the plan includes incremental operational changes in the current “open and close” triggers at existing structure

S-18C. The “open and close” triggers will be increased in increments of no more than 0.1-feet per year and the total change in either trigger shall not exceed 0.4-feet. Stage override triggers will be established immediately downstream of S-177 and/or in the adjacent agricultural lands to establish a “backstop” at which S-18C triggers will return to their existing levels. The incremental operational changes at S-18C will serve to supplement groundwater mounding in the lower C-111 area.

#### PLUG AT S-20A AND OPERATIONAL CHANGES AT S-20

The plan includes the construction of a permanent plug at existing structure S-20A in the L-31E Canal, and operational changes at existing structure S-20. The proposed plug near S-20A and proposed operational changes at S-20, specifically raising the “open and close” triggers to 0.5-feet, are intended to restore hydroperiods within the Model Land.

#### C-110 CANAL PLUGS

Finally, the plan includes construction of earthen plugs at key locations within the C-110 Canal in order to promote sheet flow within the Southern Glades. As currently envisioned, ten plugs will be constructed at semi-regular intervals by returning the existing spoil material from the canal banks to the canal. Any remaining spoil not utilized in construction of the plugs will be placed into the canal to further promote sheetflow and to lessen the effects of the of any remaining canal segments.

#### SECONDARY PROJECT COMPONENTS

Secondary Project Components are also included in the Recommended Plan for the proposed project. The Secondary Components, although included as part of the Recommended Plan, did not factor into the formulation and evaluation and were added after a primary restoration plan was selected. The Secondary Project Components are as follows: Recreation Components, Ecological Monitoring Plan, Water Quality Monitoring Plan, Draft Project Operating Manual, and OMRR&R.

#### BENEFITS OF THE PLAN

The Recommended Plan will contribute to the restoration of Everglades National Park and the adjacent southeast Florida ecosystem. The Frog Pond Detention Area and Aerojet Canal features will combine to form a hydraulic ridge that blocks the drainage effects of the C-111 Canal. As a result, rainfall and natural flows into Taylor Slough will be retained, preventing seepage that depletes the hydroperiod of Taylor Slough and alters the natural flows patterns towards the south into Florida Bay. The intermediate water control features, incremental

S-18C changes, L-31 E Canal changes, and C-110 Canal Plugs will serve to raise hydroperiods and promote sheet flow within the Southern Glades and Model Land while preserving existing levels of flood damage reduction.

Alternative 2DS will produce substantial environmental benefits while maintaining flexibility that is necessary for an Adaptive Management approach. The features of the Recommended Plan, while permanent, have the potential to be modified or augmented for future restoration plans in the Eastern Project. The flexibility of the Recommended Plan will be instrumental in balancing the limited water flows that are currently available. Additionally, a flexible plan is also necessary to modify future operations to account for any increase flows for restoration that are produced by the CERP.

For the purposes of the system-wide evaluation and plan comparison, approximately 252,000 acres of wetlands and coastal habitat may be affected by the proposed project (*FIGURE ES-1*). The results of the system-wide evaluation determined that Alternative 2DS will produce an Average Annual increase of 8,271 Habitat Units per year at an annual cost of \$10,273,000 per year. The average annual cost per average annual habitat unit is \$1,236.

The total cost for project level monitoring (Hydrometeorologic, Water Quality, and Ecological) is \$4,317,000. Endangered species monitoring (Cape Sable seaside sparrow) costs are \$2,298,000.

The recreation cost of the recommend plan is estimated at \$256,000. The average annual cost for recreation is \$45,000 and the average annual recreation benefits are \$122,000, providing a benefit cost ratio of 2.7 to 1.

The total first cost of the Recommended Plan is \$161,044,000.

#### *Water for the Natural System and Other Water-Related Needs*

The C-111 Spreader Canal Western project will produce a small amount of water for the Natural System through water diversions for the FPDA and Aerojet Canal. This water made available to the natural system will be reserved or allocated for the natural system by employing those tools provided within Florida Statutes. The proposed project will not provide any additional water for water supply or other water-related needs in the affected basins.

#### *The Savings Clause*

In addition to identifying water for the natural system and other water-related needs, Section 601(h)(5) of the WRDA 2000 requires an analysis of project effects on existing legal sources of water for municipal and agricultural interests and fish and wildlife and project effects on the levels of service for flood protection. A

project-level analysis revealed that no existing legal sources of water for the project area will be eliminated or transferred as a result of project implementation. A system-wide analysis was not conducted due to the project location at the terminus of the C&SF system and the absence of effects. The proposed project is situated at the terminus of the C&SF system, and will not affect upstream canal levels or flows. Water for fish and wildlife will be redistributed within the project area for wetland restoration; however, no elimination or transfer of this water for another use will occur. Water removed from the C-111 Canal to form a hydraulic ridge in the Detention Areas will gradually infiltrate into the ground and seep back into the canal, subsequently flowing into Florida Bay. As such, no elimination or transfer of water from Florida Bay will occur.

Regarding the level of service for flood protection, a project-level analysis was conducted to determine if the level of service for flood protection would be affected and to ensure flood protection is in accordance with applicable law. Project modeling for the proposed project indicated that 11,565 acres of land, including 776 acres of privately-owned lands, would be affected by the project. The SFWMD has agreed to acquire, in fee, or provide by supplemental agreement, the 11,565 acres of land that would be affected. No system-wide analysis was conducted due to the fact that, due to the location of the proposed project, operations of the C&SF project are not influenced as a result of project implementation.

#### ISSUES RAISED BY THE PUBLIC

Initial public and agency comments received in response to a 16 May 2002 public notice of intent to prepare a Draft Integrated PIR and EIS focused on the amount of water required to achieve restoration goals in the Model Lands, Southern Glades, and Florida Bay. Although there was general support for the project and the potential for improved habitat to benefit fish and wildlife resources, concerns included the quantity and quality of water available for the project; and the high degree of uncertainty associated with model predictions because the project area is more topographically heterogeneous than the model assumes for this region. Recommendations encouraged the expansion of the project in order to ensure Florida Bay receives the amount of freshwater required for restoration.

A number of subsequent meetings were held where stakeholders and representatives of non-governmental environmental organizations provided written comments and statements. The primary focus of their concerns centered on splitting the original plan, uncertainties about restoration opportunities in the Model Lands and Southern Glades, and the need to identify additional sources of water for delivery to Florida Bay, specifically in the dry season to sustain salinities conducive for estuarine biological and vegetative

communities. One recommended component was the need to include storage features in the upstream communities, which is an important consideration for hydration during the dry season.

Additional concerns raised included topographic uncertainties inherent to all modeling outputs; a lack of confidence in the surface flows; the need to define long-term management options; detected levels of contaminants should be evaluated for potential risks; and the design of the project should incorporate polishing wetland components and should allow for maximum restoration to freshwater and coastal wetlands.

Similar issues, as well as new concerns, were expressed during the public and agency review of the C-111 Spreader Canal Western Project Draft PIR and EIS. Specific concerns included a request for further discussion on water quality benefits; the process for implementing adaptive management and control of invasive species; concerns that the restoration plan may not be as effective if operational protocol is restricted to the management of the CSSS; possible contamination impacts of the spoil material; assurances that any discharges from the project will meet the State's water quality standards; a rise in groundwater elevations could result in root zone flooding that will be detrimental to crops; flooding risk to private agricultural property; acquisition of privately owned lands impacted by the project; expansion of exotic and invasive species; salt intrusion to the aquifer; dry season salinity affects in Manatee Bay and Barnes Sound; water quality, pesticide and contaminants in the Frog Pond Detention Area; and the potential leaching of soil contaminates into surface water and groundwater within wetlands that could pose a long-term threat to natural resources and overall water quality.

## ENVIRONMENTAL OPERATING PRINCIPLES

The proposed project is consistent with the USACE "Environmental Operating Principles" and is intended to achieve a sustainable, healthy Everglades ecosystem. During development of the proposed project, the USACE engaged the public, stakeholders, and multiple agencies in order to create a platform for a successful, collaborative planning effort. Interactions with the human environment were one of many factors considered in the system approach utilized to develop both a responsible and accountable plan. Additionally, an intricate monitoring plan has been developed to help further the adaptive assessment and management program that will help ensure the proposed project performs as anticipated.

## AGENCY TECHNICAL REVIEW

An Agency Technical Review (ATR) was performed on the Draft PIR and EIS, and another will be performed on the Final PIR and EIS pursuant to public

circulation. The ATR was conducted by a multi-disciplinary team consisting of technical staff from USACE Districts across the nation. All Review was done in accordance with recent USACE policy regarding coordination with the National Ecosystem Center of Expertise and the National Cost Engineering Directorate of Expertise.

#### INDEPENDENT EXTERNAL PEER REVIEW

An Independent External Peer Review (IEPR) was performed on the Draft PIR and EIS. The IEPR was performed by a multi-disciplinary panel of experts from the public. The Review was done in accordance with USACE policy regarding coordination with the National Ecosystem Planning Center of Expertise. All IEPR comment responses by the USACE received concurrence from the panel of experts.

#### AREAS OF CONTROVERSY

There are no substantial areas of controversy associated with the proposed project. The proposed project will result in a net beneficial improvement to the environment and will be a major factor and contributor in the recovery of the Everglades system.

#### UNRESOLVED ISSUES

There are no significant, unresolved issues that have been presented by stakeholders, public or private interests. The project will not result in a reduction in the quantity of water available to meet demands for water supply. Effects on adjacent lands have been evaluated as part of the level of service of flood protection analysis.

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**SECTION 1  
INTRODUCTION**

## 1.0 INTRODUCTION

This section will cover the background, purpose, and contextual setting of the project within the Comprehensive Everglades Restoration Plan (CERP). It includes a brief explanation of why the C-111 Spreader Canal (C-111 SC) project is being proposed and why this particular Project Implementation Report (PIR)/Environmental Impact Statement (EIS) is being prepared. This report integrates plan formulation with documentation of environmental effects. It serves to satisfy documentation requirements of the National Environmental Policy Act of 1969, as amended (NEPA).

### 1.1 COMPREHENSIVE EVERGLADES RESTORATION PLAN- BACKGROUND INFORMATION

The CERP (or the Plan) provides a framework for restoration of the diverse and significant habitats of the south Florida ecosystem, including the Everglades, which encompasses 18,000 square miles from Orlando to the Florida Reef Tract. Everglades National Park (ENP) (the largest national park east of the Mississippi River, comprising a significant portion of the greater Everglades Ecosystem) is a World Heritage Site, an International Biosphere Preserve and a Wetland of International Importance. The Everglades and the south Florida ecosystem are affected by many factors such as competing demands for recreation, development, and natural and commercial resources and include 68 federally listed threatened and endangered plants and animals.

First authorized by Congress in 1948, construction undertaken as a result of the Central and Southern Florida (C&SF) project expanded the existing network of canals, levees, water storage areas and water control structures in south Florida. Project objectives included flood control, regional water supply, prevention of saltwater intrusion, preservation of fish and wildlife, recreation and navigation. While fulfilling these objectives, the project has had unintended adverse effects on the natural environment that constitutes the Everglades and south Florida ecosystem by disrupting the pre-existing hydrologic regime. As a result, in 1996, the U.S. Army Corps of Engineers (USACE) in conjunction with the South Florida Water Management District (SFWMD) was directed to develop a comprehensive plan to restore, preserve and protect the south Florida ecosystem while providing for other water-related needs of the region such as water quality and flood protection. The resulting plan was submitted to Congress on July 1, 1999 and consists of proposed structural and operational modifications to the C&SF project.

The recommended plan, identified as the CERP, was approved to provide a framework for the restoration of the natural system under Section 601 of the Water Resources Development Act of 2000 (WRDA 2000). The plan consists of 68 different components that work together, to restore, preserve and protect the

south Florida ecosystem while providing for other water related needs of the region. The CERP components will be implemented over an approximate 40-year period. Together, these components will benefit the ecological function of more than 2.4 million acres of the south Florida ecosystem by improving and/or restoring the proper quantity, quality, timing and distribution of water in the natural system while also addressing other concerns such as urban and agricultural water supply and maintaining existing levels of flood protection.

One of the 68 components was the C-111 SC project (identified in CERP as the C-111 N Spreader Canal, component WW) located in the Lower East Coast region of Florida. The following map (*FIGURE 1-1*) shows the general C-111 SC project area in relation to the rest of south Florida.

## 1.2 REPORT AUTHORITY

(The WRDA of 2000 provided authority for the CERP in Section 601(b)(1)(A). The authorization states:

*(b) COMPREHENSIVE EVERGLADES RESTORATION PLAN. –*

*(1) APPROVAL. –*

*(A) IN GENERAL. — Except as modified by this section, the Plan is approved as a framework for modifications and operational changes to the Central and Southern Florida Project that are needed to restore, preserve, and protect the South Florida ecosystem while providing for other water-related needs of the region, including water supply and flood protection. The Plan shall be implemented to ensure the protection of water quality in, the reduction of the loss of fresh water from, and the improvement of the environment of the South Florida ecosystem and to achieve and maintain the benefits to the natural system and human environment described in the Plan, and required pursuant to this section, for as long as the project is authorized.*

The initial, conditional authorization of the C-111 SC as one of the ten initially authorized projects is contained in Section 601(b)(2)(C), (D), and (E) WRDA 2000, which states:

*(2) SPECIFIC AUTHORIZATIONS. –*

*(C) INITIAL PROJECTS. – The following projects are authorized for implementation, after review and approval by the Secretary, subject to the conditions stated in subparagraph (D), at a total cost of \$1,100,918,000, with an estimated Federal cost of \$550,459,000 and an estimated non-Federal cost of \$550,459,000:*

*(x) C-111 Spreader Canal, at a total cost of \$94,035,000, with an estimated cost of \$47,017,500 and an estimated non-Federal cost of \$47,017,500.*

*(D) CONDITIONS. –*

*(i) PROJECT IMPLEMENTATION REPORTS. – Before implementation of a project described in any of clauses (i) through (x) of subparagraph (C), the Secretary shall review and approve for the project a project implementation report prepared in accordance with subsections (f) and (h)*

*(ii) SUBMISSION OF REPORT. –The Secretary shall submit to the Committee on Transportation and Infrastructure of the House of Representatives and the Committee on Environment and Public Works of the Senate the project implementation report required by sub-sections (f) and (h) for each project under this paragraph (including all relevant data and information on all costs).*

*(iii) FUNDING CONTINGENT ON APPROVAL. — No appropriation shall be made to construct any project under this paragraph if the project implementation report for the project has not been approved by resolutions adopted by the Committee on Transportation and Infrastructure of the House of Representatives and the Committee on Environment and Public Works of the Senate.*

*(E) MAXIMUM COST OF PROJECT. – Section 902 of the Water Resources Development Act of 1986 (33 U.S.C. 2280) shall apply to each project feature authorized under this subsection.*

The proposed C-111 SC Western project will not be recommended for implementation under the initial, conditional authority for the specific C-111 Spreader Canal project identified in the Restudy and authorized in the WRDA 2000, Sections 601(b)(2)(C), (D), and (E). The C-111 SC Western project as currently proposed would exceed the maximum project cost limitations that were previously authorized. Additionally, the scope of the proposed project has been expanded to address ecological problems in Everglades National Park,

concentrating mainly on the ecological feature Taylor Slough and its downstream estuaries in Florida Bay. Due to these changes in cost, scope, and intended restoration area, the proposed C-111 SC Western project will be recommended for authorization under the CERP authority in the WRDA 2000, Section 601(d).

### 1.3 PROJECT AREA

The C-111 Canal is the southernmost canal of the C&SF Flood Control project and is located in southern Miami-Dade County. The canal serves a basin of approximately 100 square-miles and functions primarily to provide flood protection and drainage for the agricultural areas to the west and south of the city of Homestead, Florida. Southwest of Homestead and Florida City and just south of the agriculturally developed area, the C-111 Canal is joined by the C-111E and courses south to southeast through extensive marl wetland prairie and coastal mangrove marsh before it ends in Manatee Bay. The C-111 Canal and S-18C (located just south of the confluence of C-111E and C-111) were completed in 1966 and the S-197 culverts/earthen plug were completed in 1970. The S-197 structure provides a gravity outlet for stormwater runoff during flood conditions and acts as a barrier to prevent saltwater intrusion into the freshwater wetlands of the Southern Glades Wildlife and Environmental Area (SGWEA), which is located to the north of the ENP's eastern panhandle. The C-111 Canal is also the final segment of the South Dade Conveyance System (SDCS). The canal provides a means to deliver water to ENP's Taylor Slough and the eastern panhandle to meet the minimum water delivery schedule under Federal Statute (F.S. [Public Law {PL} 91-282]).

Part of the C-111 SC project area falls within the South Dade Wetlands, which include the Model Land and the Southern Glades (*FIGURE 1-1*). The western portion of the Model Lands is made up of the wetlands in the north C-111 Basin, located adjacent to the C-111 Canal, east of ENP, west of U.S. Highway 1, north of Southwest 424<sup>th</sup> Street and south of State Road (SR) 9336, with the exception of active agricultural land. The eastern portion of the Model Land includes the wetlands south of Southwest 344<sup>th</sup> Street (Palm Drive), east of U.S. Highway 1, and south to Biscayne Bay, Card Sound and Barnes Sound.

The Southern Glades region is bounded by ENP to the south and west, U.S. Highway 1 to the east, and the Model Lands to the north except for the far western edge, west of C-111E, that extends further north to the boundary of the Frog Pond. The SFWMD owns most of the property in the Southern Glades Region. The South Dade Wetlands form a contiguous habitat corridor with ENP, Biscayne National Park, Crocodile Lakes National Wildlife Refuge, the north Key Largo Conservation and Recreational Lands (CARL) purchases, John Pennekamp State Park, and the existing National Marine Sanctuary.

## 1.4 PURPOSE AND SCOPE

### 1.4.1 Original Project Purpose and Scope

In 1999, the USACE completed the C&SF Project Comprehensive Review Study (Restudy). The purpose of the Restudy was to re-examine the C&SF project to “determine the feasibility of structural or operational modifications to the project essential to the restoration of the Everglades and the south Florida ecosystem, while providing for other water related needs such as urban and agricultural water supply and flood protection in those areas served by the project (WRDA 1996).” The intent of the study was to evaluate conditions within the south Florida ecosystem and make recommendations to modify the C&SF project in order to restore important functions and values of the Everglades and south Florida ecosystem and to plan for the water resources needs of the people of south Florida for the next 50 years. The selected plan (Alternative D13-R) was published in the “Final Integrated Feasibility Report and Programmatic Environmental Impact Statement (PEIS) for the C&SF Project”, dated April 1999. The selected plan was approved under the WRDA 2000 as the CERP.

The C-111 SC project was initially, conditionally authorized under the WRDA 2000 as one of the initial set of CERP projects that would serve to “jump-start” restoration in the natural system. The primary restoration purpose for the C-111 SC project identified in the Restudy was:

“...to improve deliveries and enhance the connectivity and sheetflow in the Model Lands and Southern Glades areas, reduce wet season flows in C-111, and decrease potential flood risk in the lower south Miami-Dade County area.”

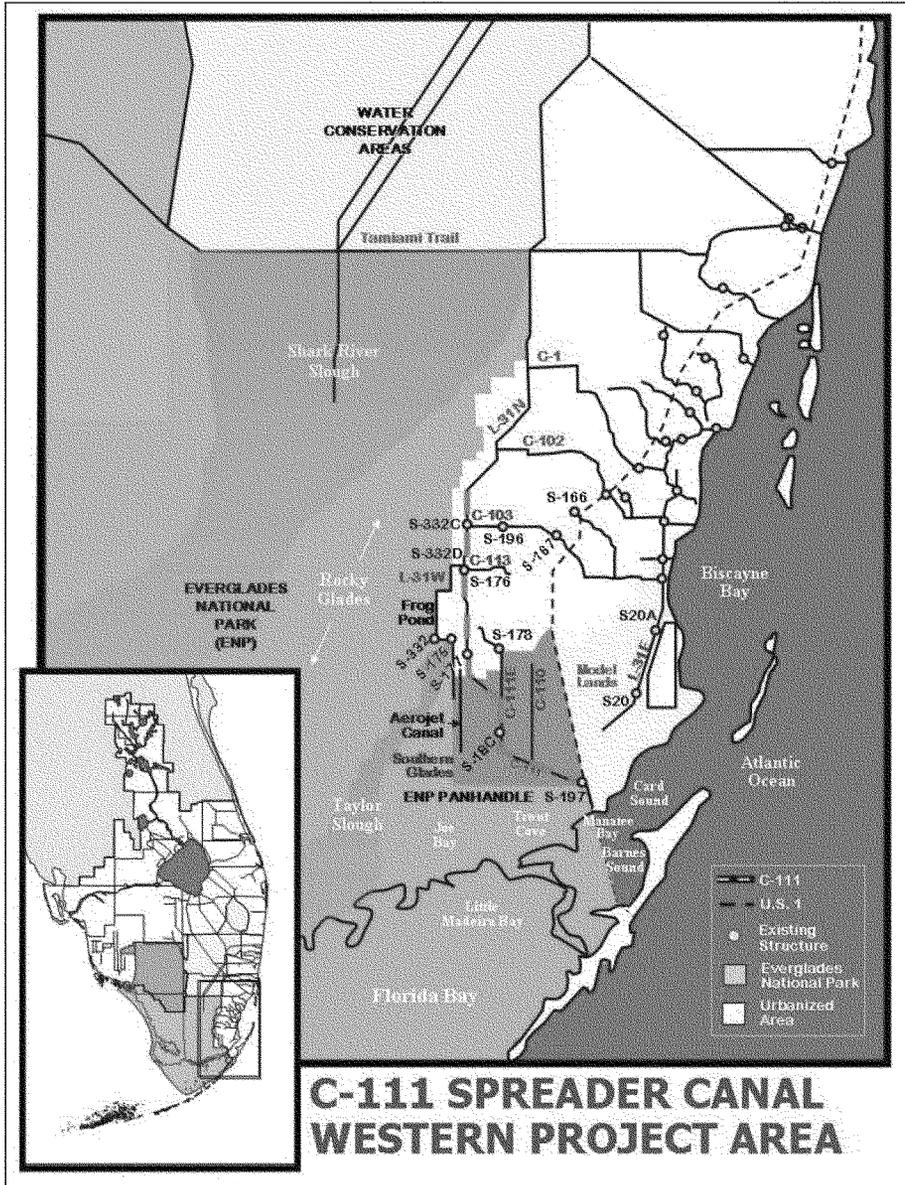
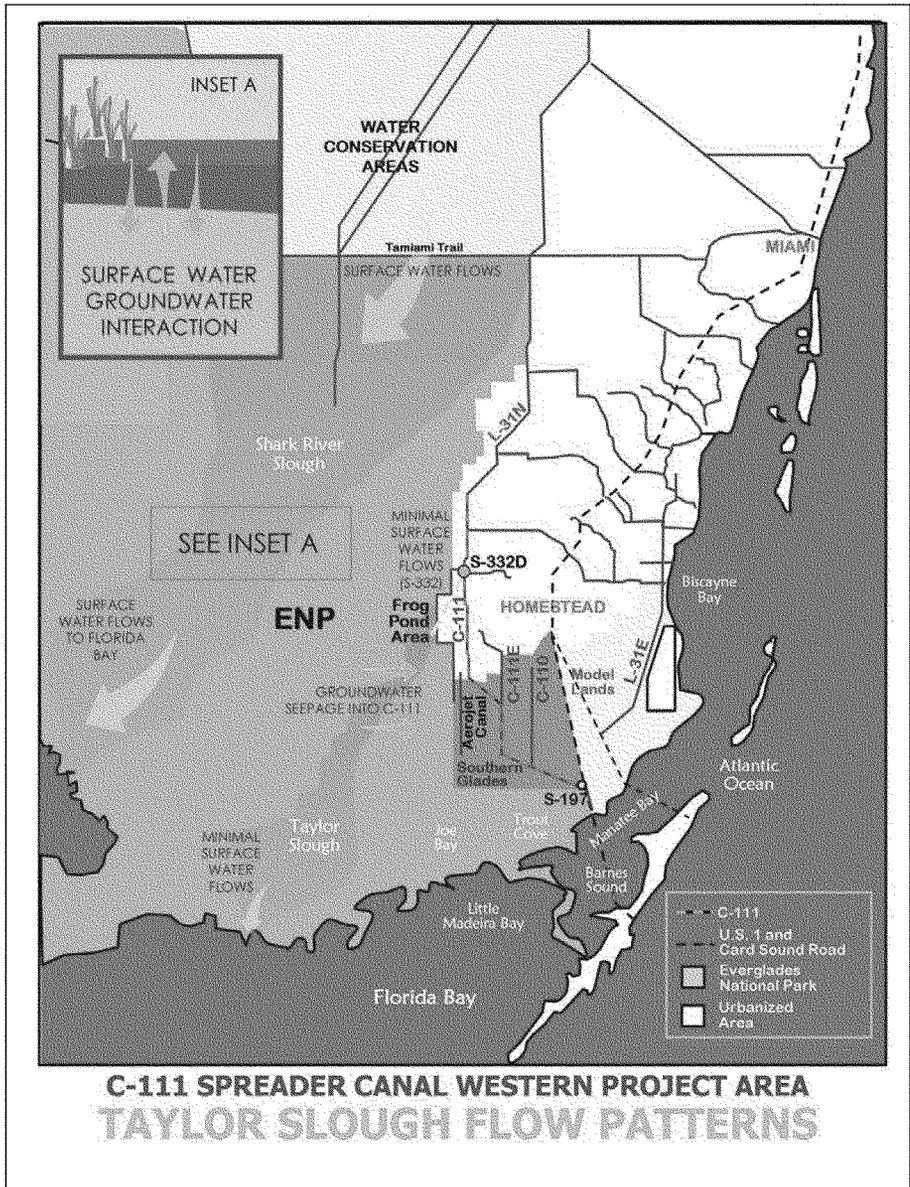


FIGURE I-1: PROJECT AREA



**FIGURE 1-2: TAYLOR SLOUGH FLOW PATTERNS**

#### 1.4.2 Changes Since The Restudy

Shortly after the approval of the CERP, a Project Delivery Team (PDT) was formed and began to evaluate and further formulate the plan for the C-111 SC project. During this time, a great deal of ecological research on the project area was published. Where only weak scientific evidence of water management practices and the resulting ecological stressors was present during the compilation of the Restudy, the public had now produced the results of long term scientific research that had been conducted in Everglades National Park and Florida Bay. Research in the area indicated that the dynamics of water flows were directly correlated to the breeding success of wading birds (Russell 2002). Additionally, it was noted that changes in small demersal fish communities seemed to lead to reductions in top trophic-level consumers in the Everglades (Lorenz 2006). The large numbers of predatory fauna in the Everglades such as alligators, crocodiles, and wading birds are instrumental in maintaining the fine balance that exists in the ecosystem. Reductions in freshwater flows and subsequent disruptions in salinity levels in Florida Bay were identified as the culprit that was reducing population numbers of large predators in this portion of the Everglades (Lorenz 2006).

The research that was published allowed for the identification of deficiencies in the potential for restoration of the project study area. Specifically, the project goals and objectives that were identified in the Restudy did not completely address the entire needs of the ecosystem. Additionally, a great deal of uncertainty with proposed project features was identified. A Formulation Strategy Paper was drafted and circulated for review that addressed proposed project issues and identified methods to achieve a solution.

As noted in papers drafted by both the Department of the Interior (DOI) and Everglades Foundation, the project as proposed would distribute high volumes of water east of the C-111 Canal, while no water would be re-directed to the west of the canal. Additionally, the DOI did not believe that the proposed C-111 SC project would “provide enough ecological lift to reduce hypersalinites found in central Florida Bay.”

Another issue with the 1999 *Central and Southern Florida Comprehensive Review Study Final Integrated Feasibility Report and Programmatic Environmental Impact Statement* (Yellow Book) proposal was the uncertainty associated with the construction of water quality features and the spreader canal. Although preliminary modeling analyses were utilized to predict the effects of these two features, the team believed that actual operation of these features on a limited scale would be necessary to accurately predict effects. The team felt that the formulation and implementation of these features would best be developed through Incremental Adaptive Restoration (IAR). Through the use of IAR, these two project features could be optimized to produce maximum

benefits while keeping project costs to a minimum by avoiding relocation or elimination of initial project features.

#### 1.5 RELATIONSHIP TO OTHER U.S. ARMY CORPS OF ENGINEERS/NON-FEDERAL SPONSOR EFFORTS, STUDIES, DOCUMENTS, AND REPORTS

Although there are several environmental restoration efforts in the vicinity of the proposed C-111 SC project, the efforts are not expected to have any effects on the planning and design of the proposed project. The proposed C-111 SC project is situated at the “end” of the Everglades, where the wetland system ceases overland flow and empties into Florida Bay and its associated estuarine environments. The C-111 SC project would only receive water from other CERP projects. The proposed project would not send water to any other systems nor would any other projects rely on it for operations.

Listed within this section are brief descriptions of other key projects related to the C-111 SC project. Also included are short statements regarding any possible effects related to the C-111 SC Western project and if available the timing for implementation of these related projects.

##### 1.5.1 C-111 Project

The C-111 General Re-evaluation Report (GRR) with an integrated EIS was completed and approved in 1994. The GRR provided for modifications to the C&SF project north of the C-111 SC area that would benefit the Taylor Slough portion of ENP. The project modifications were designed to maintain existing flood protection and other C&SF project purposes in developed areas east of C-111 SC project area while reducing seepage losses out of the eastern portion of ENP by creating a hydraulic ridge in a series of impoundments just west of the main C-111 Canal.

Flows would be diverted to Taylor Slough by the following components:

- Taylor Slough Bridge Replacement
  - Completed in October 2000
- Pump stations S-332A and S-332D
  - Construction of S-332D completed in 1997
  - Construction of S-332B completed in 2001
  - Construction of S-332C completed in 2002
  - Construction of additional features of C-111 is ongoing
- L-31W and S-332D Tieback Levees—Construction of two new north-south levees roughly parallel to existing L31N beginning at L31W near S175 and extending northward in the Rocky Glades area to the S-332A pump station.

The 1994 GRR also included recommendations to construction and implement a Spreader Canal with a 50 cfs pump and ten plugs in the C-110 Canal. These features were subsequently transferred to the CERP to be implemented under the C-111 SC project.

Changes in the implementation schedule for the 1994 GRR project would not have any effect on the proposed C-111 SC Western project. The Western project is not dependent on the 1994 GRR project for any construction features or operations.

#### 1.5.2 Modified Water Deliveries to Everglades National Park Project

The authorized improvements for the modified water delivery (MWD) project are structural modifications and additions to the existing C&SF project required to enable water deliveries for the restoration of more natural hydrologic conditions in ENP. Together, these improvements would enable the re-establishment of the historic Shark River Slough flow-way from Water Conservation Area (WCA) 3A through WCA 3B to ENP.

The General Design Memorandum (GDM) for the MWD project was approved in May 1993. The Project Cooperation Agreement (PCA) was executed in September 1994 and construction was initiated in 1995. Construction of new spillway structures S-355A and B and the raising of the Tigertail Indian Camp have been completed. Land acquisition is near completion for the 1992 flood mitigation levee/canal right-of-way around the 8.5 Square Mile Area (8.5 SMA).

Although the MWD project will influence the C-111 SC project, the only direct effects that will occur are possible increases in the amount of water available to the proposed C-111 SC Western project area. Additionally, water available to the C-111 SC project may be improved in quality. All features of the proposed C-111 SC project would be constructed regardless of the MWD project implementation schedule.

#### 1.5.3 Interim Structural and Operational Plan, and Interim Operational Plan

A minimum schedule of water deliveries from C&SF project to the ENP was authorized by Congress in 1969 in PL 91-282. Section 1302 of the Supplemental Appropriations Act of 1984 (PL 98-181), passed in December 1983, authorized the USACE, with the concurrence of the National Park Service (NPS) and the SFWMD, to deviate from the minimum delivery schedule for two years in order to conduct an experimental program of water deliveries to improve conditions within the ENP. Section 107 of PL 102-104 amended PL 98-181 to allow continuation of the experimental program until modifications to the C&SF project authorized by Section 104 of the ENP Protection and Expansion Act of 1989 (PL 101-229) were completed and implemented.

Test Iteration 7 of the experimental program of MWD to ENP (herein referenced as the 1995 Base) was initiated in October 1995 (USACE, 1995). In February 1999, the U.S. Fish and Wildlife Service (FWS) issued a Final Biological Opinion (BO) under provisions of the Endangered Species Act (ESA), which concluded that the provisions of Test 7, Phase I were jeopardizing the continued existence of the Cape Sable seaside sparrow (CSSS). They further concluded that ultimate protection for the species would be achieved by implementing the MWD project (PL 101-229) as quickly as possible. In the opinion of the FWS, the FWS BO presented a Reasonable and Prudent Alternative (RPA) to Test 7, Phase I of the experimental program that would avoid jeopardizing the CSSS during the interim period leading up to completion of the MWD project. The FWS RPA recommended that certain hydrologic conditions be maintained in the CSSS's breeding habitat to avoid jeopardizing the continued existence of the species. In January 2000, the experimental program was terminated, and in March 2000, Test 7, Phase I was replaced by the current Interim Structural and Operational Plan (ISOP) (USACE, 2000). The ISOP was designed to meet the conditions of the FWS RPA included in the FWS BO from March 2000 until implementation of the Interim Operational Plan (IOP). The USACE was recently authorized by the Council on Environmental Quality (CEQ) to conduct emergency operations under ISOP 2001 for the 2001 nesting season. The ISOP will be in place until completion of the EIS and a Record of Decision (ROD) is signed for the IOP. Once the ROD is signed, the IOP will replace the ISOP and continue FWS RPA protective measures for the CSSS until implementation of the MWD project.

The Draft IOP EIS was published in the Federal Register in February 2001. Since that time, the CEQ Institute of Environmental Conflict Resolution has facilitated an interagency team from the USACE, FWS, SFWMD and ENP to formulate a consensus alternative that meets the criteria in the BO, while providing for maximum protection of the resource concerns of interested parties. A Supplemental Draft IOP EIS, which contains the analysis of the consensus plan was published in the Federal Register in October 2001.

Modeling for the C-111 SC project utilized the IOP as the basis for operations in the proposed project area. The IOP will continue to be the operational plan for the C&SF system in the proposed project area until the time that another operational plan is proposed and authorized.

#### 1.5.4 Biscayne Bay Coastal Wetlands Project in the Comprehensive Everglades Restoration Plan

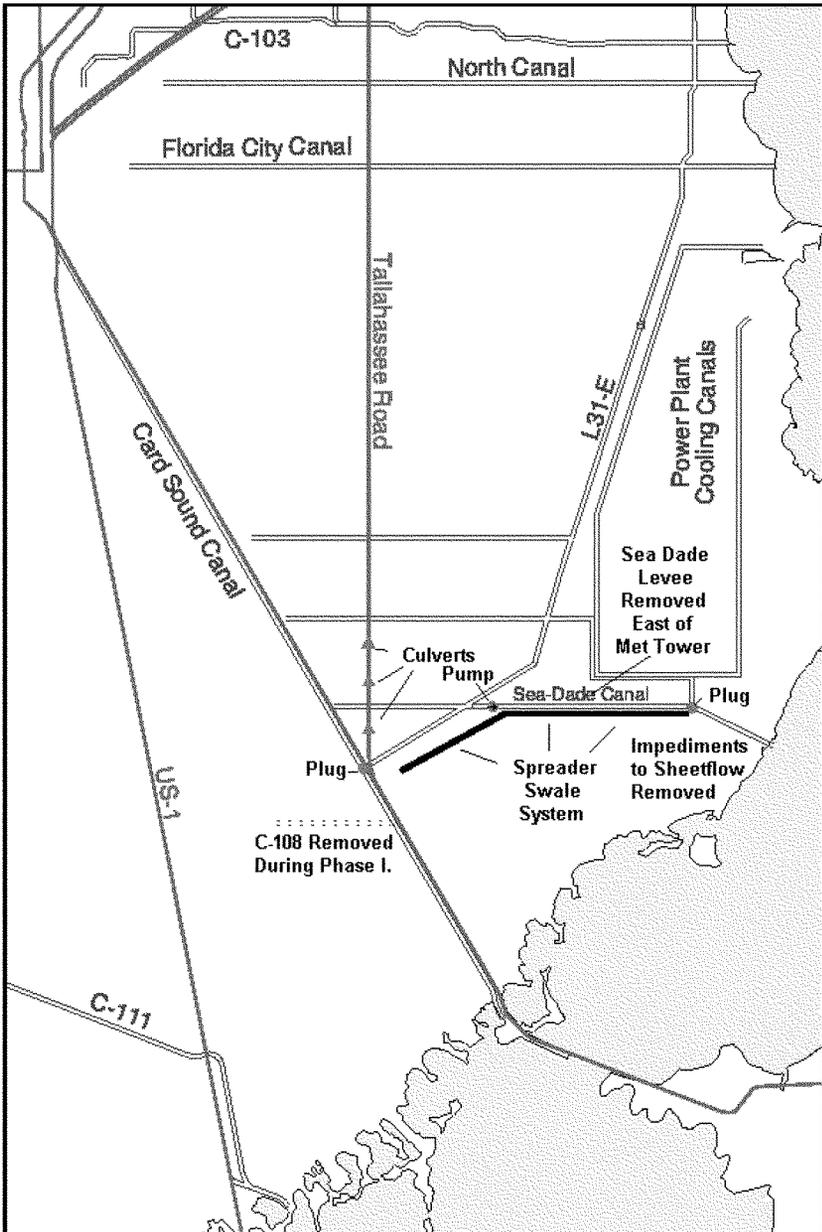
The purpose of the Biscayne Bay Coastal Wetlands (BBCW) project is to rehydrate wetlands and reduce point source discharge, improve water quality and provide more natural timing and quantity of water to Biscayne Bay. The proposed project would replace lost overland flow and partially compensate for

the reduction in groundwater seepage by redistributing available surface water entering the area from regional canals.

The BBCW project would not affect any of the project area that is proposed for both C-111 SC projects. Additionally, it has been determined that the BBCW project and C-111 SC project will not compete for water to accomplish restoration purposes. The water that will be utilized for restoration in the BBCW project is completely derived from a different drainage basin than the water that will be utilized for the C-111 SC Western project.

#### 1.5.5 Florida Power and Light Company South Dade Mitigation Bank

The Florida Power & Light (FP&L) South Dade Mitigation Bank is 13,367 acres of wetland interspersed within the model lands project area. It is located south of Florida City and east of U.S. Highway 1 (*FIGURE I-3*). The site has been divided into four major project phases. The bank will seek to restore the biologic and hydrologic functions of the area. This would be done through a conservation easement on the property, exotic vegetation removal and replanting, removal of unnatural physical improvements such as roads and canals, hydrologic improvement and threatened and endangered species enhancement. At this time, phase one has been completed and permitting of phase two is in progress. An analysis of effects on the mitigation area as a result of the C-111 SC project is located in the 404(b)(1) Analysis contained in this PIR.



**FIGURE 1-3: FLORIDA POWER AND LIGHT MITIGATION BANK**

### 1.5.6 RMC South Florida, Inc. Mitigation Area

RMC South Florida, Inc. owns and operates rock mines between U.S. Highway 1 and Card Sound Road, south of Florida City. As mitigation for the rock mines, approximately 1,147 acres in the northern part of the Model Lands, north of the mining operation are to be restored. The focus would be on removal of a large concentration of invasive/exotic vegetation. Hydrologic improvements are needed in the area, but would not be significantly achieved as part of the mitigation plan. Florida International University (FIU) would aid in the planning and monitoring of the restoration. Following the initial restoration, it is planned that FIU will receive the land through a donation. FIU would then be responsible for the long-term maintenance of the area as required by the permit. An analysis of effects on the mitigation area as a result of the C-111 SC project is located in the 404(b)(1) Analysis contained in this PIR.

### 1.6 COMPREHENSIVE EVERGLADES RESTORATION PLAN-MASTER IMPLEMENTATION SEQUENCING PLAN

Included with Section 10 of the *Final Integrated Feasibility Report and Environmental Impact Statement*, dated April 1999, was the original sequencing plan for the implementation of the CERP. Section 10 described the project implementation process and the schedules developed to implement the recommended plan. Subsequent to the completion of the aforementioned EIS, the Implementation Plan was updated in July 2001, and was known as the Master Implementation Schedule (MIS 1.0). MIS 1.0 updated the Implementation Plan and documented the status of CERP at that time.

The MIS 1.0, dated March 2005, built on these previous efforts and incorporated new information, implementation experience to date and changes in legislation. Some of the new information included the requirements in WRDA 2000 and the subsequent Programmatic Regulations, as well as the effects of streamlining contained in the State of Florida's Expedited Construction initiative (an accelerated implementation schedule for several CERP components). Acceler8 was re-named Everglades Restoration Resource Area (ERRA) and is now the State Expedited Construction program. All future Acceler8 and ERRA work will be categorized as State Expedited Construction, and termed as such unless used in a direct quotation. The State's Expedited Construction will hasten the CERP implementation while maintaining relationship of the MIS 1.0 and the partnership between USACE and SFWMD. The MIS 1.0 identified the C-111 SC as a Band 1 project, with an anticipated construction completion date of 2008. The current construction completion date for the C-111 SC Western project is 2010.

### 1.6.1 Local Efforts to Accelerate Elements of the Comprehensive Plan

The State of Florida and the SFWMD have been working to accelerate implementation of certain elements of the Restudy including the C-111 SC. Typically, the USACE process for implementing civil work projects involves completing a feasibility report that identifies a recommended plan, and within that report, provides a level of detail at or about the 30 percent design level. This equates to completion of a conceptual design with all major design components identified, providing sufficient detail for the development of construction cost estimates. Under the current policy, design work on the selected plan cannot be initiated until after the Division' Engineer's transmittal letter is released after completion of the PIR.

As a result of the lengthy process to obtain approval of a PIR, the immediate needs of the environment are not being met and long delays in implementing the CERP project for the C-111 Basin will result in further damage to an already fragile ecosystem. Consequently, SFWMD has undertaken the State Expedited Construction program initiative to hasten the design and construction of components identified in the Restudy. The State of Florida has directed the SFWMD to design and construct a number of CERP projects (State Expedited Construction) in coordination with the development of the PIR. Per CERP Guidance Memorandum #2 (GM #2):

“For each PIR that encompasses an Acceler8 project, the proposed Acceler8 project will be analyzed as one of the alternative plans considered or encompassed within the alternatives considered in the PIR. If the selected alternative plan includes the features proposed to be constructed by the South Florida Water Management District under the proposed Acceler8 project program, then the Acceler8 project and those Acceler8 features should be identified to be implemented as Part 1 of the first phase of construction of the selected alternative plan.”

The State Expedited Construction project for the C-111 Basin is currently at the 60 percent design level, with a preliminary design for the Frog Pond Detention Area being completed for review. The current configuration of the Frog Pond Detention Area is for a three-cell detention area consisting of 590 acres. Surface flows would be diverted from the C-111 Canal and a groundwater mound would be formed west of the C-111 Canal and east of Taylor Slough. The mound would serve to reduce an eastward migration of flow away from Taylor Slough into the C-111 Canal. During the dry season, the detention area could serve as a water storage facility during large storm events, with a storage capacity of over 1,000-acre feet.

SECTION 2  
EXISTING CONDITIONS/AFFECTED ENVIRONMENT

## 2.0 EXISTING CONDITIONS/AFFECTED ENVIRONMENT

### 2.1 GENERAL DESCRIPTION

The western portion of the proposed project area is composed of Everglades National Park (ENP) and the adjacent wetland areas east to the South Dade Wetlands. Taylor Slough in ENP is the main ecological feature located within the proposed project area. The Slough is a large natural water conveyance feature typical of the Everglades and is characterized by deeper water and higher flows than the surrounding wetlands. It flows towards the south and eventually empties into Florida Bay.

The hydrological condition of Taylor Slough is an excellent indicator of the ecological health of this portion of ENP; however, the construction of massive conveyance and drainage features, mainly the C-111 Canal, has acutely altered the hydrology of Taylor Slough and thus the ecological health of the slough is in severe decline. Because of the extreme porosity of the ground in this area, the C-111 Canal creates a negative gradient that causes groundwater to flow or seep out of the Slough into the Canal. As a result, water levels in the Slough and subsequent flows into Florida Bay are extremely lower than normal. The poor condition of Taylor Slough has been well documented and is evident in recent studies that have noted significant declines in the numbers of nesting birds, particularly Roseate Spoonbills.

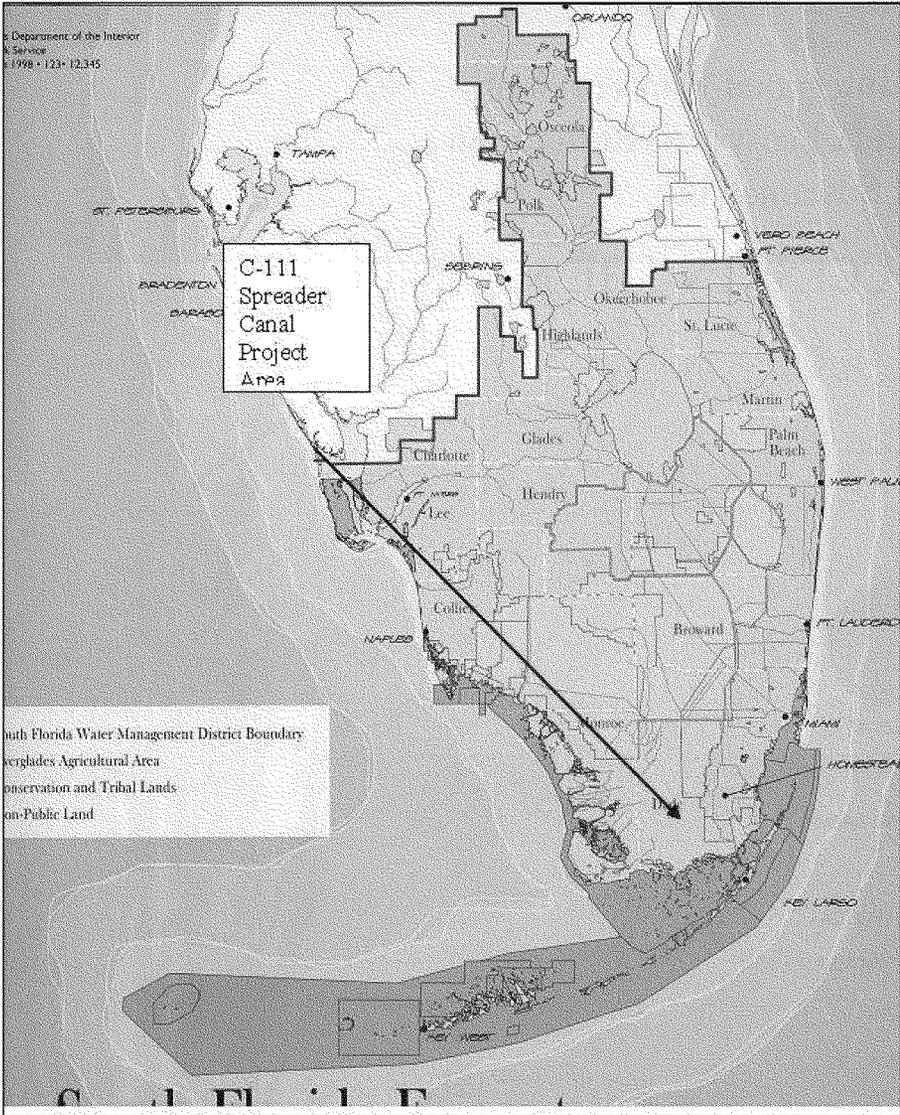
The South Dade Wetlands (SDW) form a large portion of the proposed project area. The SDW form a contiguous habitat corridor with ENP, Biscayne National Park (BNP), Crocodile Lakes National Wildlife Refuge, the north Key Largo CARL purchases, the North Key Largo Hammocks Botanical Park, John Pennekamp State Park and the existing National Marine Sanctuary. The SDW is divided into the Model Lands and the Southern Glades, and is isolated from direct surface water flows from the Everglades by a series of roads and flood-control canals. Approximately 80 percent of the land in the SDW has not been directly disturbed for human use; disturbance has generally been limited to changes in hydrology. Where physical disturbance has occurred, the most frequent cause is agriculture. Essentially all of the farming activities within the management area have ceased. Previously farmed lands have re-vegetated, in some cases with invasive exotic species. Extreme hydroperiod events have changed the structure and function of this once hydrologically connected basin. Over-drainage has shortened hydroperiods in the marshes adjacent to the C-111 Canal. This change has displaced the historic function of the lower basin wetlands and has provided recruitment opportunities for exotic plants and animals.

The western portion of the Model Lands is made up of the wetlands in the north C-111 Basin, located adjacent to the C-111 Canal, east of ENP, west of U.S.

Highway 1, north of Southwest 424<sup>th</sup> Street and south of SR 9336, with the exception of active agricultural land. The eastern portion includes the wetlands south of Southwest 344<sup>th</sup> Street (Palm Drive), east of U.S. Highway 1, and south to Biscayne Bay, Card Sound, and Barnes Sound. The SFWMD and Miami-Dade County currently own over 12,000 acres of the approximately 32,000 acres included in the joint acquisition project. The remaining 20,000 acres is made up of over 1,200 individual tracts.

The Southern Glades region is bounded by ENP to the south and west, U.S. Highway 1 to the east and the Model Lands to the north except for the far western edge, west of C-111E that extends further north to the boundary of the Frog Pond. The SFWMD owns almost all of this property totaling over 30,000 acres.

The project team identified approximately 155,000 acres of uplands, freshwater wetlands, and estuarine wetlands that may be directly or indirectly impacted by the project. The alternatives considered for this project are expected to directly affect 10,000 to 20,000 acres of wetlands located directly adjacent to the project features. The balance of the acreage is analyzed to determine if indirect project benefits or adverse effects would accrue to areas not directly adjacent to project features. An additional 98,000 acres of nearshore estuarine habitat was identified as potentially affected by this project. Since the C-111 Spreader project diverts water rather than augments water deliveries, the project delivery team felt that having large indicator regions was essential to capturing both positive and negative effects of the project. Maps of the potentially affected areas are found in *Appendix C* of this document.



**FIGURE 2-1: C-111 SPREADER CANAL PROJECT AREA**

## 2.2 CURRENT ECOLOGICAL DESCRIPTION

The SDW are located in the extreme southeastern lobe of the Everglades system. The land is low-lying and very flat, with natural elevations generally less than one meter above sea level. The soils are predominantly marls, mixed with and grading into peat soils near the coastline. Undeveloped areas contain predominantly wetland vegetation, plus disturbed, rural upland areas with roads, levees and other man-made features. The region supports a variety of wetland dependent wildlife, including several state- and federally-listed endangered and threatened wildlife species.

As a consequence of past and current water management practices, land development and sea level rise, freshwater wetlands in the project area have been reduced in areal extent, altered and degraded. Currently much of this area is drained. Water elevations are generally held close to or below land surface in the northern project area, or starved of water as in the Model Lands areas where water is diverted by drainage structures toward other basins. The current operation of the systems has resulted in an inland migration of saline conditions in both the groundwater and surface waters such that the expansion of moderate to high salinity zones have diminished the spatial extent of freshwater wetland habitats, and have allowed the landward expansion of saltwater and mangrove wetlands, including low-productivity, sparsely vegetated dwarf mangrove communities typical of the hypersaline “white zone.” Some wetlands have been impacted by invasive exotic vegetation as a result of physical disturbance and/or hydrologic isolation. A more comprehensive characterization of salinity throughout Taylor Slough and Florida Bay can be found in FWC FWRI Technical Report TR-11 (Hunt and Nuttle; 2007).

## 2.3 VEGETATION COMMUNITIES

The primary factors influencing the distribution of vegetation in this region are hydropattern, salinity, previous disturbance, and to a lesser extent, nutrient loading and soil type. The C-111 Spreader Canal, including both the Western and Eastern project areas, is divided into five ecological/vegetation zones (*FIGURE 2-2*). Ecological Zone 1 is considered to be the mostly developed area north of the Model Lands and Southern Glades, consisting of residential and agricultural areas, and the business communities of Florida City and Homestead; within this zone, certain tracts have been purchased by Miami-Dade County for conservation or recreation or those preserved as buffer lands for the Florida Keys Aqueduct Authority. Ecological Zone 2 is a shrub-dominated freshwater marsh. At this highest elevation, the sawgrass prairie alternates with forested wetlands. Ecological Zones 3 and 4 are various sawgrass communities, showing the transition from more freshwater to higher salinity water. The dominant vegetation community in the region is a matrix of sawgrass prairie with tree islands (Ecological Zone 3). The tree islands vary in

vegetation composition, depending upon elevation. Some tree islands in Ecological Zone 4 have freshwater species in the interior section, and are ringed with mangrove or salt-tolerant species. At the lowest elevations near the coast mangroves replace the freshwater wetlands. The transition zone between the mangroves and the freshwater prairie is a needle rush-salt grass zone on the freshwater side, but stunted scrub mangrove on the coastal side. Zone 5 is the hypersaline “white zone,” notable due to its appearance on remotely-sensed images as a white band, and sparse vegetation with stunted mangroves. Recent (2000) studies in this area indicate that the inner boundary of the white zone has moved inland by an average of one and a half kilometers since 1940 and the zone is expanding. The most significant changes have occurred on the Biscayne Bay side of U.S. Highway 1. The low productivity of the white zone may be primarily due to wide seasonal fluctuations in salinity and moisture content and the absence of freshwater input from upstream sources. *TABLE 2-1* lists the plants commonly found in any particular ecological zones.

The plant community can strongly influence wildlife composition and patterns of utilization. The plant community types present in the SDW Management Area (SDWMA) include sawgrass glades, spike rush and beak rush flats, muhly prairie, cypress stands, native dominated forested wetlands, tree islands, mangrove flats, hydric hammocks, and exotic-dominated forests. Natural disturbances, such as fire, play an important role in maintaining a diverse mosaic of vegetation communities. Altered hydroperiods, wildfire suppression and human caused fires have disrupted the natural frequency and pattern of fires in the region.

Invasive species present in the SDWMA include melaleuca (*Melaleuca quinquenervia*), Australian pine (*Casuarina* spp.), and Brazilian pepper (*Schinus terebinthifolius*), among others. The heaviest impacts from invasive species tend to occur in disturbed areas within the SDWMA, such as abandoned farmland and lands in the immediate vicinity of roads and berms. Such areas are frequently dominated by nearly monotypic stands of invasive plants. Elsewhere, these invasive plants are present in smaller, but no less important numbers in tree islands, marshes, and mangrove forests as a result of long distance seed dispersal. In other regions of the county, such outlier populations have rapidly expanded to create additional problems when left untreated.

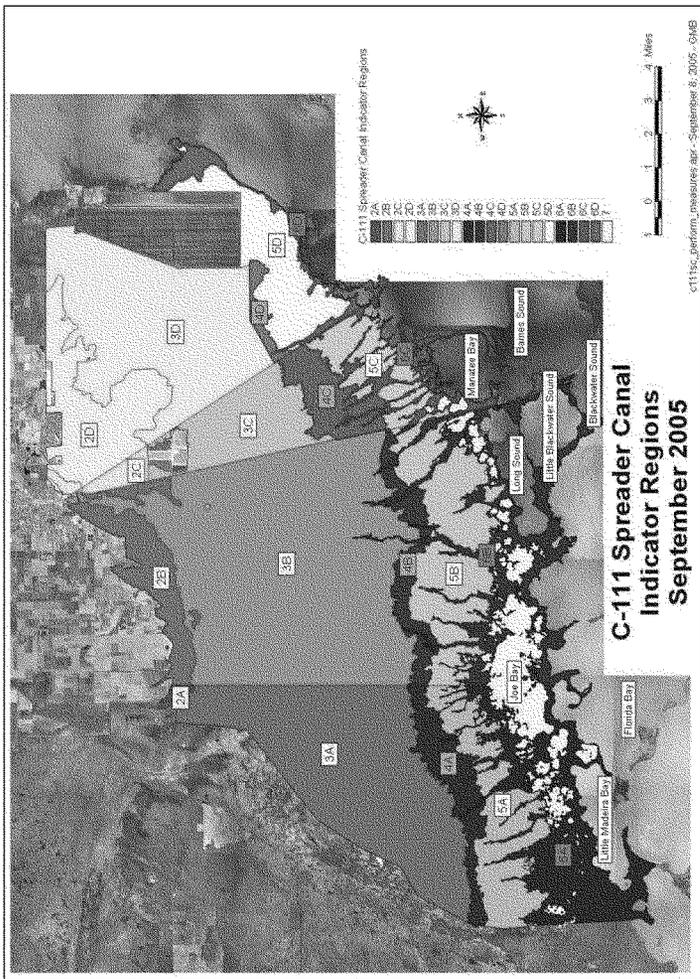


FIGURE 2-2: ECOLOGICAL/VEGETATIVE ZONES WITHIN PROJECT AREA

**TABLE 2-1: COMMON VEGETATION WITHIN ECOLOGICAL ZONES**

Zone	Landscape	Common Plants Found in Zones
2	Shrub dominated forested wetland	Brazilian pepper ( <i>Schinus terebinthifolius</i> ), Australian pine ( <i>Casuarina</i> spp.), dahoon holly ( <i>Ilex cassine</i> ), swamp bay ( <i>Persea palustris</i> ), sweet bay ( <i>Magnolia virginiana</i> ), willow ( <i>Salix caroliniana</i> ), and sawgrass ( <i>Cladium jamaicense</i> )
3	Sawgrass	Sawgrass, muhly grass ( <i>Muhlenbergia capillaris</i> ), swamp bay, dahoon holly, wax myrtle ( <i>Myrica cerifera</i> ), willow, and cocoplum ( <i>Chrysobalanus icaco</i> ), sweet bay, myrsine ( <i>Rapanea guianensis</i> ), bald cypress ( <i>Taxodium distichum</i> ), and pond apple ( <i>Annona glabra</i> )
4	Mixed graminoid with mangroves	Sawgrass, swamp bay, dahoon holly, wax myrtle, cocoplum, myrsine, poisonwood ( <i>Metopium toxiferum</i> ), buttonwood ( <i>Conocarpus erectus</i> ), red mangrove ( <i>Rhizophora mangle</i> ), stoppers ( <i>Eugenia</i> spp.), spicewood ( <i>Calypttranthes pallens</i> ), and cocoplum
5	White zone ecotone	Dwarf red mangroves, sparse graminoids
6	Coastal forest	Red mangrove, white mangrove ( <i>Laguncularia racemosa</i> ), Brazilian pepper, Australian pine, wax myrtle, poisonwood, buttonwood, spicewood, myrsine, stoppers, white indigo berry ( <i>Randia aculeata</i> )

## 2.4 FISH AND WILDLIFE RESOURCES

The following material summarizes the habitat usage by wildlife that exists within the boundaries of the SDW. A total of forty-five fish species, fourteen amphibian species, forty-six reptilian species, fourteen mammalian species, and 178 avian species have been documented to occur in the SDW. At least thirty-six state or federally listed animal species utilize the SDW, twelve are endangered and eight are threatened. The following sections describe habitat use and provide species lists and species status for macroinvertebrates, amphibian, reptilian, fishes, birds, and mammalian species found on location.

### 2.4.1 Macroinvertebrates

Macroinvertebrates comprise the largest and most diverse group of organisms in the SDW. These organisms are a vital component of the food chain, often being the base of the animal food chain. During the wet season, prawns, crayfish, crabs and snails such as the Florida apple snail (*Pomacea paludosa*) become prevalent. The apple snail is a vital food source for the limpkin (*Aramus guarauna*), a Species of Special Concern, and the Endangered Everglades snail kite (*Rostrhamus sociabilis plumbeus*).

Dragonflies and mayflies are diverse and abundant in the sawgrass marsh. Coleoptera, Diptera, and Hemiptera are also common. Many species of water bugs and beetles are widely distributed throughout this area. Many of these macroinvertebrates find food and security from predation in sawgrass roots, naiads, bladderwort, water grass, and periphyton, which may house millions of these macroinvertebrates. One study found over 280 species within the periphyton blanket (FPL, 1997).

#### 2.4.2 Amphibians

The SDW contain sixty amphibians, characteristic of wetland habitats in south Florida. This is more than one-third of all amphibian species known to exist in Florida. This high diversity is a result of the critical geographic location, connection to BNP and ENP, diversity of habitat, weather conditions, and geological history. Within the C-111 project area, there are twelve surveyed amphibian species utilizing the area. The deepwater marsh ecosystem provides habitat for the pig frog (*Rana grylio*) and green tree frog (*Hyla cinerea*). The shallow wetland marsh provides habitat for the high diversity of species. Those species most frequently found in this area include the eastern narrow-mouthed frog (*Gastrophryne carolonensis*), little grass frog (*Pseudacris ocularis*), and the southern leopard frog (*Rana sphenoccephala*), probably the most common native frog in the region.

Amphibians, particularly frogs, are important monitors of environmental conditions. The present, absence, or fluctuations of frog populations can be clues to the ecological conditions that exist, including acid rain levels, radiation levels, disease, predator-prey fluctuations, exotic intrusion, and combinations of these factors.

#### 2.4.3 Reptiles

At least forty-six species including six listed species use the freshwater wetland or coastal habitats. Critical habitat exists for the American crocodile (*Crocodylus acutus*). Historically, Miami-Dade County was at the core of the American crocodile geographic range in the United States (Kushlan and Mazzotti, 1989), with the coastal wetlands along the western shore of Biscayne Bay providing important habitat. Today, higher salinity that now characterizes the western bay and adjacent wetlands have severely reduced the suitability of this area for juvenile crocodiles, which require relatively low salinity for proper growth and development.

The American alligator is critical in the production of many deep-water habitats with the construction and maintenance of “gator holes.” These deep ponds provide important habitat for invertebrates, amphibians, and fish species that congregate in these areas during the winter dry season. Regionally, overall

numbers of alligators have declined substantially, and their distribution patterns have greatly altered, as a result of water and land management practices. Reductions of alligators coupled with over-drained wetlands have caused the loss of many small ponds (also known as “holes”) that were essential for the survival of small aquatic animals during dry seasons.

The endangered eastern indigo snake has been observed in the sawgrass prairies and upland habitat. Eastern indigo snakes utilize a wide variety of habitat types in southern Florida, including tropical hardwood hammocks, pine rocklands, freshwater marshes, abandoned agricultural land, coastal prairie, mangrove swamps, and human-altered habitats. Therefore, almost all the C-111 SC project study area can be considered suitable eastern indigo snake habitat (with the exception of deeper water habitats, marine, and highly disturbed [pavement, rock quarries, buildings]).

Other common reptiles found in the deep marsh area include water snakes such as the black swamp snake (*Seminatrix pygaea*) and cottonmouth (*Agkistrodon piscivorus conanti*), and turtles such as the Florida cooter (*Chrysemys floridana*), red-bellied turtle (*Chrysemys nelsoni*), and mud turtle (*Echinosternum baueri*). Common reptiles found in the slightly drier shallow marsh and wet prairie systems include pygmy rattlesnake (*Sistrurus miliaris*) and chicken turtle (*Deirochelys reticularia*) (FPL, 1997).

#### 2.4.4 Fish

Fish provide a critical food base for many species that are associated with the SDW. Fish populations are influenced by the fluctuations in water levels, availability of deepwater areas, habitat connectedness, storms and other climatic conditions, as well as human alterations to the environmental (i.e., canals, gates). Common native fish include mosquitofish (*Gambusia holbrooki*), sailfin molly (*Poecilia latipinna*), and least killifish (*Heterandria formosa*).

Small minnow-sized fish species dominate most of the freshwater wetlands. This dominance most likely is due to the water fluctuations and dry downs that naturally and unnaturally occur in this area. Many of the small native fish are adapted for survival in low oxygenated water, high temperatures, and shallow stagnate water. A good example of this is the mangrove rivulus (*Rivulus marmoratus*), a Species of Special Concern, which exists in mangrove habitats and spends most of its life in land crab burrows.

The estuaries in the project area are considered to be essential fish habitat (EFH). The EFH Assessment, which describes the habitat and potential fish, and possible effects of the project, may be found in the *Environmental Information, Annex A*.

#### 2.4.5 Birds

Except for macroinvertebrates, birds represent the most diverse group of animals that use the SDW. One hundred and seventy-eight (178) species are known to inhabit this area including seven Federal- or State-listed Threatened and Endangered species and ten Species of Special Concern. Most of these listed species rely on freshwater wetland habitat that is available in the SDW. Many of these are wading birds, including the little blue heron (*Egretta caerulea*), tricolored heron (*Egretta tricolor*), snowy egret (*Egretta thula*), wood stork (*Mycteria americana*), limpkin (*Aramus guarauna*), roseate spoonbill (*Ajaja ajaja*), and white ibis (*Eudocimus albus*). The populations of most wading birds and many other waterbirds have declined greatly within the past few decades. Most of the wading birds are observed foraging in the sawgrass prairies and fringes of open water habitats. Other waterbirds that are known to feed and nest in the area include the mottled duck (*Anas fulvigula*), common gallinule (*Gallinula chloropus*), least tern (*Sterna albifrons*), least bittern (*Ixobrychus exilis*), osprey (*Pandion haliaetus*), red-shouldered hawk (*Buteo lineatus*), king rail (*Rallus elegans*), common yellowthroat (*Geothlypis trichas*), and red-winged blackbird (*Agelaius phoeniceus*).

The Everglades snail kite has been infrequently observed in the western portions of the SDW. These birds feed principally on the apple snail, a common snail in the wetland marshes. The apple snail is dependent on natural water levels fluctuations.

Small numbers of roseate spoonbills have been observed flying and feeding within SDW boundaries. These birds breed primarily in ENP, on mangrove islands in Florida Bay. No nest sites have been observed in the SDW. Along with roseate spoonbills, wood storks require high concentrations of food as a result of changing hydrologic conditions for successful breeding. In the past years, conditions in the SDW have not been ideal for foraging during the breeding season. Currently, this area is used as a foraging habitat for adult and juvenile birds during non-breeding seasons. A Species of Special Concern is the white ibis, the most abundant wading bird observed in the area. Large populations of these birds can be observed foraging in the sawgrass prairie. The species numbers tend to increase during the winter months. This bird is believed to nest on some of the mangrove islands located on the coastal edge of the SDW.

The least tern frequents the canals and open water areas of the SDW. Many of these birds can be observed traveling up and down the L-31 E Canal between the months of May and August. These birds feed on small fish located close to the surface.

A State-listed species that relies heavily on the SDW for foraging and roosting is the white-crowned pigeon. This bird can be observed throughout the year foraging in the tree islands and hammocks. This bird feeds primarily on the seeds of the poisonwood tree.

#### 2.4.6 Mammals

Mammals make up only a small number of the wildlife associated with the SDW. Like most wetland systems there is a low diversity of species; however these species are an important component of the overall system. Four of the fourteen mammals using this area are endangered or threatened and another two are being considered for listing. Historical records from the late 1980s document that an adult female panther used a large portion of the SDW as a feeding area. Although manatees have historically been documented in C-111 Canal as far north as S-177, they do not currently have access north of S-197. Common mammals include the white-tailed deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), bobcat (*Felis rufus*), black rat (*Rattus rattus*), otter (*Lutra canadensis*), and house mouse (*Mus musculus*).

The round-tailed muskrat (*Neofiber alleni*) has been severely impacted by the lost of wetland habitat. Populations of this species have plummeted in recent years and the species is now being considered for listing. This species is typically found in wetland habitat with emergent vegetation. Another mammal, the Everglades mink (*Mustela vison evergladensis*), has also suffered due to its vulnerability to hydrologic patterns within its niche.

The only bat believed to exist in the SDW is the state-listed Florida mastiff bat (*Eumops glaucinus floridanus*). This species is extremely rare. The last individual was observed caught in Coral Gables in 1988.

#### 2.4.7 Exotic Species

Many of the exotic fish species are found in human-altered habitats. These species include the peacock bass, oscar, Mayan cichlid, jewelfish and spotted tilapia. These exotic predators are aggressive hunters and have a severe effect of many smaller native fish

Exotic reptile and amphibian species known to breed in the project area include the Cuban tree frog (*Hyla septentrionalis*), Cuban brown anole (*Anolis sagrei sagrei*), giant toad (*Bufo marinus*), spectacled caiman (*Caiman crocodilus*), and the Indo-Pacific gecko (*Hemidactylus garnoti*) and Mediterranean gecko (*Hemidactylus turcicus*). Currently, these species do not appear to pose problems here, as they are readily consumed by birds and snakes (FPL, 1997).

## 2.4.8 Threatened and Endangered Species

The FWS (July 14, 2008) has determined that twenty federally listed threatened or endangered species may occur within the project area that could be affected by the proposed action. In addition, the project area includes areas of designated critical habitat for the American crocodile, Everglade snail kite, West Indian manatee, elkhorn coral, staghorn coral, and the CSSS. The Biological Assessment describes the effects of the C-111 SC Western project on listed species and their critical habitat (*Environmental Information, Annex A*). Detailed accounts of these species, including description of their distribution, habitat, critical habitat, reproduction, foraging, movements, status and trends, and respective recovery plan objectives, are contained within the South Florida Multi-Species Recovery Plan (FWS, 1999); these sections are found in the *Environmental Information, Annex A*. **TABLE 2-2** provides a list of federally- and state-listed species.

TABLE 2-2: FEDERALLY AND STATE-LISTED SPECIES

Common Name	Scientific Name	Listing Status	Principle Listing Agency
<b>Birds</b>			
Arctic peregrine falcon	<i>Falco peregrinus tundrius</i>	Endangered	Florida
Black skimmer	<i>Rynchops niger</i>	Special Concern	Florida
Brown pelican	<i>Pelecanus occidentalis</i>	Special Concern	Florida
Cape Sable seaside sparrow*	<i>Amodramus maritimus mirabilis</i>	Endangered	Federal
Everglades snail kite	<i>Rostrhamus sociabilis plumbeus</i>	Endangered	Federal
Least tern	<i>Sterna antillarum</i>	Threatened	Florida
Limpkin	<i>Aramus guarana</i>	Special Concern	Florida
Little blue heron	<i>Egretta caerulea</i>	Special Concern	Florida
Piping plover	<i>Charadrius melodus</i>	Threatened	Florida
Reddish egret	<i>Egretta rufescens</i>	Special Concern	Florida
Roseate spoonbill	<i>Ajaja ajaja</i>	Special Concern	Florida
Roseate tern	<i>Sterna dougallii dougallii</i>	Threatened	Federal
Snowy egret	<i>Egretta thula</i>	Special Concern	Florida
Tricolored heron	<i>Egretta tricolor</i>	Special Concern	Florida
White-crowned pigeon	<i>Columba leucocephalus</i>	Threatened	Florida
White ibis	<i>Eudocimus albus</i>	Special Concern	Florida
Wood stork	<i>Mycteria americana</i>	Endangered	Federal
<b>Reptiles</b>			
American alligator	<i>Alligator mississippiensis</i>	Threatened/SA	Federal
American crocodile*	<i>Crocodylus acutus</i>	Threatened	Federal
Eastern indigo snake	<i>Drymarchon corais couperi</i>	Threatened	Federal
Gopher tortoise	<i>Gopherus polyphemus</i>	Special Concern	Florida
Miami black-headed snake	<i>Tantilla oolitica</i>	Threatened	Florida
Green sea turtle	<i>Chelonia mydas</i>	Endangered	Federal

Leatherback sea turtle	<i>Dermochelys coriacea</i>	Endangered	Federal
Hawksbill sea turtle	<i>Eretmochelys imbricata</i>	Endangered	Federal
Loggerhead sea turtle	<i>Caretta caretta</i>	Threatened	Federal
Kemp's Ridley sea turtle	<i>Lepidochelys kempii</i>	Endangered	Federal
<b>Mammals</b>			
Everglades mink	<i>Mustela vison evergladensis</i>	Threatened	Florida
Florida mastiff bat	<i>Eumops glaucinus floridanus</i>	Endangered	Florida
Florida panther	<i>Puma concolor coryi</i>	Endangered	Federal
West Indian manatee*	<i>Trichechus manatus</i>	Endangered	Federal
<b>Fish</b>			
Smalltooth sawfish	<i>Pristia pectinata</i>	Endangered	Federal
Mangrove rivulus	<i>Rivulus marmoratus</i>	Special Concern	Florida
<b>Invertebrates</b>			
Elkhorn coral	<i>Acropora palmata</i>	Threatened	Federal
Staghorn coral	<i>Acropora cervicornis</i>	Threatened	Federal
Florida tree snail	<i>Liguus fasciatus</i>	Special Concern	Florida
Schaus swallowtail butterfly	<i>Heraclides aristodemus ponceanus</i>	Threatened	Federal
<b>Plants</b>			
Bracted colic root	<i>Aletris bracteata</i>	Endangered	Florida
Crenulate lead plant	<i>Amorpha crenulata</i>	Endangered	Federal
Eatons spikemoss	<i>Selaginella eatonii</i>	Endangered	Florida
Garber's spurge	<i>Chamaesyce garberi</i>	Threatened	Federal
Lattace vein fern	<i>Thelypteris reticulate</i>	Endangered	Florida
Mexican vanilla	<i>Manilla mexicana</i>	Endangered	Florida
Pine-pink orchid	<i>Bletia purpurea</i>	Threatened	Florida
Tiny polygala	<i>Polygala smalii</i>	Endangered	Federal
Tropical fern	<i>Schizaea pennula</i>	Endangered	Florida
Wright's flowering fern	<i>Anemia wrightii</i>	Endangered	Florida

\* Critical habitat designated for this species

SA: Similarity of Appearance species

## 2.5 ESSENTIAL FISH HABITAT

The project is located in areas designated as EFH for coral and live bottom habitat, red drum (*Sciaenops ocellatus*), shrimp, spiny lobster (*Panulirus argus*), other coastal migratory pelagic species, and the snapper-grouper complex. Specifically, EFH in Florida Bay is comprised of seagrasses, estuarine mangroves, intertidal flats, estuarine water column, live/hard bottoms, and coral reefs.

## 2.6 CLIMATE

The climate of the project study area is considered subtropical, with distinct wet and dry seasons, high rates of evapotranspiration (ET), and climatic extremes of floods, droughts, and hurricanes. This climate represents a major physical

driving force that sustains the Everglades while creating water supply and flood control issues in the agricultural and urban segments. Climatic variability is extremely important in maintaining extreme high and low water events that constitute natural cycles and drive wetland processes. Of the 53 inches of rain that south Florida receives annually on the average, 75 percent falls during the wet season months of May through October. Multi-year high and low rainfall periods often alternate on a time scale approximately on the order of decades (USACE and SFWMD, 1999). The mean annual temperature for the southern Everglades is 76°F (24°C) (Thomas, 1974).

Various sites along the east coast of Florida indicate that the sea level is rising at a rate above the global average, at 8.85 inches over the last 100 years (Maul and Martin, 1993). If the sea level rise continues as predicted, it is foreseeable that there will be an increase in saltwater intrusion into the well-fields in the project area, and salt-tolerant (coastal) vegetation could move further inland.

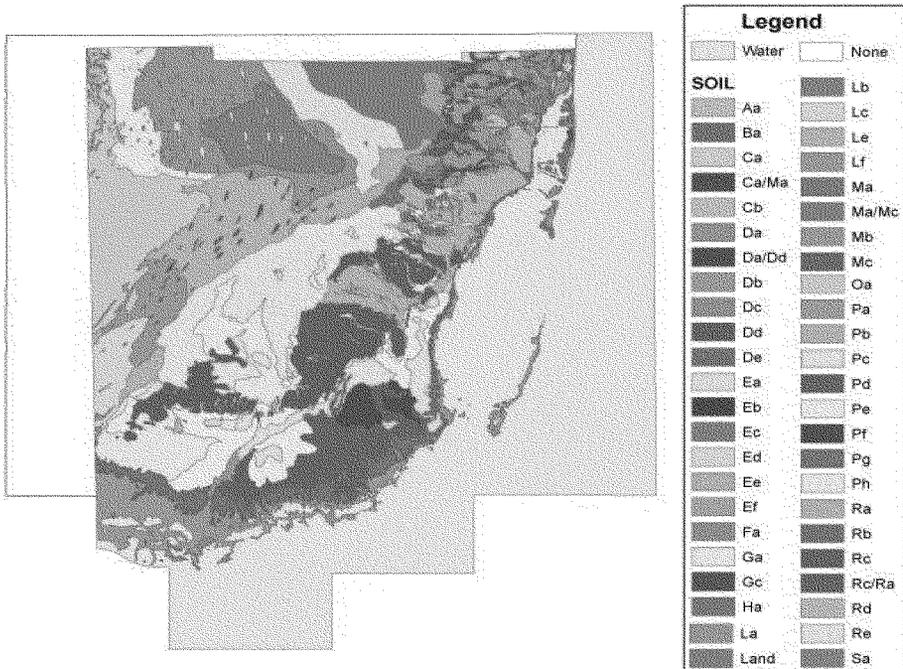
## 2.7 LANDSCAPE: GEOLOGY AND SOILS

South Florida is underlain by Cenozoic-age rocks to a depth of approximately 5,000 feet below land surface (bls) and is comprised of various percentages of sand, limestone, clay and dolomite (Meyer, 1989). Thin strands of sand and the Miami Limestone underlie most of the lower Florida east coast and form the highest elevations in the area corresponding to the Atlantic Coastal Ridge physiographic province. The Miami Limestone is a relatively thin unit, going from 15 to 20 feet bls. Underlying the Miami Limestone, the Fort Thompson Formation is a sandy limestone formation with scattered sand lenses. The Fort Thompson ranges from 30 to 60 feet thick and is also very porous (Perkins, 1977).

The marl soils found within the project area are typically characterized as silts with high concentrations of lime. They form under shallow water conditions and represent an important constituent of the whole ecosystem. Marl soils typically have standing water for short periods of time, and are associated with thick algal mats and periphyton. Eleven of the thirteen soil types located in the area are classified as being wetland soils. The following is a list of each of the soils by name, and a description of their characteristics can be obtained from the U.S. Department of Agriculture (USDA) Natural Resource Conservation Service's (NRCS's) Soil Survey of Dade County Area, Florida: Lauderhill muck; depressionnal, Pennsuco marl; Perrine marl; drained, Udorthents-water complex; Udorthents, marl substratum-Urban land complex; Perrine marl; Biscayne marl; Dania muck; depressionnal, Biscayne marl; drained, Perrine marl; tidal, Pahokee muck; depressionnal, Pennsuco marl; and tidal, Terra Ceia muck.

The main soil type found in the project area is Perrine Marl. Perrine Marl complexes are generally uniform and are represented by shallow layers of soil

(marl) (0-24 inches) on top of extremely porous limestone bedrock. Soil subsidence due to drainage by man-made features such as the C-111 Canal is a substantial problem in such soil types, and these soils are extremely susceptible to erosion from dryouts and fires. There is also an extremely high level of hydraulic conductivity in the substrate of this area due to the porous limestone. Vegetative health and proper soil thickness and composition in the area are directly correlated, and the lack of the upper soil horizons are generally associated with poor water retention and decreased periphyton mats. As such, decreases in hydroperiod as a result of drainage features, has led to poor soil deposition rates, and in turn disrupted vegetative communities. See *FIGURE 2-3* below for soil type distribution in south Florida.



Soil	Name	Soil	Name
Aa	Arzell fine sand	Le	Loxahatchee peat shallow phase over shallow marl
Ba	Broward fine sand	Lf	Loxahatchee peat shallow phase over shallow sand
Ca	Coastal beach	Ma	Made land
Ca/Ma	Coastal beach	Ma/Mc	Made land
Cb	Cypress swamp (unclassified soils)	Mb	Mangrove swamp; unclassified soil
Da	Dade fine sand	Mc	Mines, pits, and dumps
Da/Dd	Dade fine sand	None	Not specified
Db	Davie fine sand	Oa	Ochopee fine sandy marl, shallow phase
Dc	Davie fine sand, shallow phase	Pa	Palm Beach fine sand
Dd	Davie mucky fine sand	Pb	Parkwood fine sand
De	Davie mucky fine sand, shallow phase	Pc	Perrine marl
Ea	Everglades peat	Pd	Perrine marl, peat substratum phase
Ec	Everglades peat, shallow phase	Pe	Perrine marl, shallow phase
Eb	Everglades peat over shallow marl	Pf	Perrine marl, shallow, peat substratum phase
Ee	Everglades peat, shallow phase over shallow marl	Pg	Perrine marl, tidal phase
Ed	Everglades peat, shallow phase over deep sand	Ph	Perrine mail, very shallow phase
Ef	Everglades peat, shallow phase over shallow sand	Ra	Rockdale fine sand
Fa	Flamingo marl	Rb	Rockdale fine sand, undulating phase - Limestone complex
Ga	Gandy peat	Rc	Rockdate fine sandy loam, level phase - Limestone complex
Gc	Gandy peat, shallow phase	Rc/Ra	Rockdate fine sandy loam, level phase - Limestone complex
Ha	Hialeah mucky marl	Rd	Rockdale fine sandy loam - Limestone complex
La	Loxahatchee peat	Re	Rockland
Land	Not ascertained for this nonarable land type	Sa	St. Lucie fine sand
Lb	Loxahatchee peat, deep phase	Water	Not specified
Lc	Loxahatchee peat over shallow marl		

**FIGURE 2-3: MIAMI-DADE SOILS MAP**

## 2.8 WATER MANAGEMENT (OPERATIONS)

The purposes of the canal system in South Dade County are: to remove 40-percent standard project flood runoff from the effective drainage area; to reduce depth and duration of larger floods; provide water control to prevent over drainage in the area; prevent saltwater intrusion; and provide facilities to convey water to ENP when runoff is available. The ENP SDCS modified the existing project works in the South Dade County.

The current operation of the SDCS, as detailed in the May 2002 FEIS IOP, was developed to meet legal requirements of the ESA in regard to the effects of water management operations on the endangered CSSS while balancing the other federally mandated purposes of flood control and water supply. IOP was developed to address these needs within the existing limitations of the current water management system while the necessary structural modifications associated with the C-111 and MWD projects are underway.

### 2.8.1 Flood Control

Water management and flood control is achieved in south Florida through a variety of canals, levees, pumping stations, and control structures within the WCA and ENP/SDCS. The WCAs provide a detention reservoir for excess water from the Everglades Agricultural Area and parts of the east coast region, and for flood discharge from Lake Okeechobee to the sea. The WCAs provide levees to: prevent Everglades floodwaters from inundating the east coast urban areas; provide a water supply for the east coast areas and ENP; improve water supply for east coast communities by recharging underground freshwater reservoirs; reduce seepage; protect against salt-water intrusion in coastal well-fields; and provide habitat for fish and wildlife in the Everglades.

The regulation schedules contain instructions and guidance on how project spillways are to be operated to maintain water levels in the WCAs. The regulation schedules essentially represent the seasonal and monthly limits of storage. The schedules vary from high stages in the late fall and winter to low stages at the beginning of the wet season. These regulation schedules must take into account various, and often conflicting, purposes.

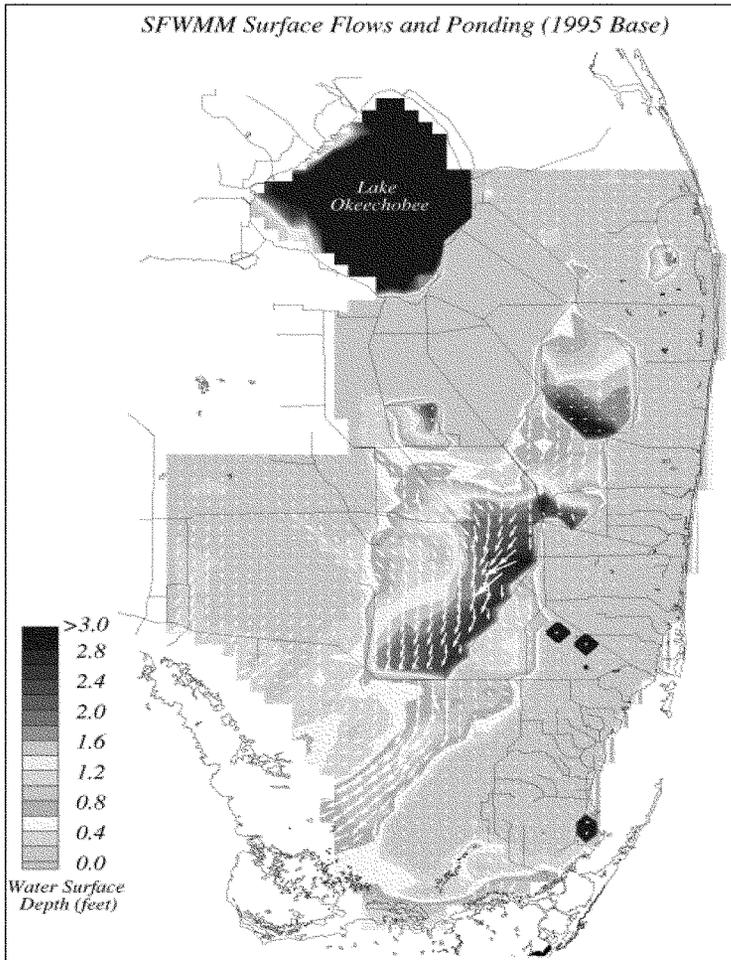
The East Coast Canals are flood control and outlet works that extend from St. Lucie County southward through Martin, Palm Beach, and Broward counties to Dade County. The East Coast Canal watersheds encompass the primary canals and water control structures located along the lower east coast of Florida and their hydrologic basins. The main design functions of the canals and structures in the East Coast Canal area are to: protect the adjacent coastal areas against flooding; store water in conservation areas west of the levees; control water elevations in adjacent areas; prevent salt-water intrusion and over

drainage; provide freshwater to Biscayne Bay and provide for water conservation and public consumption. There are forty independently operated canals, one levee, and fifty operating structures, consisting of thirty-five spillways, fourteen culverts, and one pump station. The flood control system works to prevent major flood damage. However, due to urbanization, the existing surface water management system now has to handle greater peak flows than in the past.

The ENP-SDCS provides a way to deliver water to areas of South Dade County. This canal system was overlain on top of the existing flood control system. Many of these canals are used to remove water from interior areas to tidewater in times of excess water.

## 2.9 HYDROLOGY-POST-CENTRAL AND SOUTHERN FLORIDA PROJECT

The C&SF project and urban development disrupted the natural pattern as illustrated in the historical conditions section, resulting in flow and stage patterns shown in *FIGURE 2-4* below. The C-111 Basin presents deeper water elevations than the pre-drainage conditions and different flow distribution, particularly in the Taylor Slough and 8.5 SMA.



Source: Poster presented by: Dr. Jayantha Obeysekera, P.E. and Liz Stoeff of the South Florida Water Management District – SOFIA –USGS

**FIGURE 2-4: SOUTH FLORIDA WATER MANAGEMENT MODEL SURFACE FLOWS AND PONDING (1995 BASE)**

In order to restore the original conditions on the C-111 area, the flow patterns and distribution in ridges and sloughs would have to be restored.

### 2.9.1 Water Supply

The ENP-SDCS was authorized for the purpose of improving the supply and distribution of water supplies to ENP and for expanding agricultural and urban needs. Before supplemental water is introduced into the system, canal stages are permitted to recede approximately 1.5 feet below the design optimums.

Optimum and design water levels in the project canals are established on the basis of desirable water control conditions in each area, i.e., optimum groundwater levels, intake and/or discharge structure elevations and removal rates for flood control. Along the east coast salinity control is included as a requirement of canal-level design criteria.

#### 2.9.1.1 Salt Water Intrusion

The Biscayne Aquifer underlies approximately 3,000 square miles of Dade, Broward, and southern Palm Beach counties. It is a surficial, highly permeable, wedge-shaped aquifer that ranges from about 100-400 feet in depth along the coast and thins to a few feet thick near its western boundary thirty-five to forty miles inland. This aquifer provides water for municipal and industrial (M&I) water supply and agricultural irrigation along the southeast coast. Seepage and water supply releases from the WCAs recharge the surficial aquifers and prevent saltwater intrusion along the coast. The C&SF system is designed so that, except at coastal salinity structures, canal stages in general may be permitted to recede approximately 1.5 feet below the optimum levels before supplemental water must be introduced into the ENP-SDCS.

#### 2.9.1.2 Water Deliveries to the Eastern Panhandle of Everglades National Park via the C-111 Canal

The purpose of S-18C is to maintain desirable water levels in the upstream reach of C-111 Canal, pass flood flows up to forty percent standard project flood without exceeding design stages upstream, and act as a control point for water deliveries to the Eastern Panhandle of the ENP. The minimum monthly water releases for the ENP is shown on *TABLE 2-3* below.

**TABLE 2-3: MINIMUM MONTHLY DELIVERY SCHEDULE AT EASTERN PANHANDLE (AS DELIVERED AT S-18C)**

Month	Acre-Feet	Month	Acre-Feet
January	1,540	July	510
February	630	August	860
March	290	September	2,690
April	110	October	4,630
May	110	November	4,060
June	340	December	2,230

The purpose of S-197 is to maintain sufficient water control stages in the upstream section of C-111 Canal to prevent saltwater intrusion. Originally constructed as an earthen plug which would be excavated before or after major storm events, three gated culverts were subsequently added in order to avoid the over drainage, and damaging freshwater releases, associated with excavating the canal plug.

Following a particularly damaging discharge in 1988, the SFWMD installed ten additional culverts at S-197 adjacent to the three original culverts. The added operational flexibility provided by the thirteen gated culverts has significantly lowered the volume of unnecessary discharges before, during, and after major storm events.

Additional reductions in the frequency, degree, and duration of S-197 openings have also been realized by removal of the spoil mounds adjacent to the lower C-111 Canal. Currently, water which discharges from S-18C, is allowed to flow over the scraped down canal banks into ENP's panhandle, and towards Florida Bay.

Even further reductions in the frequency, degree, and duration of S-197 openings have been realized as a result of SFWMD's construction of a new gated culvert structure, G-211, in the L-31N Borrow Canal immediately south of its intersection with C-1. As a result, during the experimental program, there has been a reduction in the need for S-331 discharges. With G-211 in place, S-331 has been used to pump water levels in the canal immediately adjacent to the 8.5 SMA in order to drain groundwater from the area. Previously, S-331 had to pump water levels in the L-31N Canal all the way upstream to U.S. Highway 41. However, the existing IOP described below allows for regulatory releases to be passed into ENP-SDCS via S-333, S-334, G-211, and S-331, which typically increase pumping at S-331.

## 2.10 WATER QUALITY

The discharge of phosphorus laden runoff into the Everglades Protection Area has resulted in undesirable changes to the oligotrophic ecology of this area. Nutrient and pesticide loading are of concern in the Lower C-111 Basin due to the proximity of intensive agricultural operations in the basin. In the early 1990s, the federal government sued the State of Florida to compel the state to enforce its water quality criteria and protect the Everglades system from excessive phosphorus discharges. The 1991 Settlement Agreement ended this lawsuit and resulted in a Consent Agreement whereby the State was responsible for monitoring phosphorus discharges into the Everglades and working to resolve violations.

### 2.10.1 Nutrients and Dissolved Oxygen

Since 1992, the SFWMD has published the quarterly “Settlement Agreement Reports” that summarize compliance with phosphorus standards set for LNWR, Shark River Slough, and Taylor Slough. The C-111 Basin is covered in this agreement by the Taylor Slough compliance standards. In the original Consent Decree, the Taylor Slough long-term phosphorus limit was set to 11 parts per billion (ppb) as measured by the flow-weighted concentrations at the S-332, S-175, and S-18C structures. Subsequent changes to structure operations and the construction of new structures has required that the compliance measurement locations be changed to the S-332D, S-174, and S-18C structures. Over the 16 years (1991-2007) of compliance monitoring and reporting, the Consent Decree standard of 11 ppb has been violated in one year (1994). More recently, the annual flow-weighted average total phosphorus concentration for the Taylor Slough compliance locations has been below 8 ppb since 2001 and is trending towards 5 ppb which is very close to the natural background concentration. Though the Consent Decree standards are routinely met at the compliance locations, the C-111E Basin presents an area that has elevated phosphorus concentrations. Measurements at S-178, on the C-111E Canal present the highest total phosphorus (TP) concentrations (24 ppb) of any structure in the C-111 Basin (Pfeuffer, 1998a-d).

Florida Department of Environmental Protection’s (FDEP’s) (Fike, 2003) analysis of 1990-2000 SFWMD data collected at S-197 (station AR03) showed a relatively low mean concentration of ammonia (0.06 milligrams per liter [mg/L]) and nitrate nitrogen (0.04 mg/L). The 1990-2000 data collected at S-177 showed a mean concentration of ammonia and nitrate nitrogen of 0.13 and 0.09 mg/L, respectively. Dissolved oxygen (DO) mean concentration of 5.8 was well above the state standard for DO of 5.0 mg/L, albeit seven percent of the reported values were below 2 mg/L. The low DO concentrations (less than 2 mg/L) all occurred during the warmer months (June thru October); such low oxygen concentrations values could potentially result in fish kills in C-111 Canal or in Manatee Bay.

### 2.10.2 Pesticides

The Homestead agricultural area, which lies northeast of the proposed project features, sustains a productive agricultural industry that depends, in part, on the use of agrochemicals. Between 1993 and 1997, the National Oceanic and Atmospheric Administration (NOAA) conducted a contaminant study of the C-111 Canal and Florida Bay (Scott et al., 2002), and determined that the pesticides endosulfan, atrazine, chlorpyrifos, and chlorothalonil were present in the canals adjacent to agricultural areas within the C-111 Basin.

As described in *Appendix C.6.4.1*, data collected by the Non-Federal Sponsor (NFS) confirms that elevated levels of endosulfan historically (prior to 2001) existed within the C-111-E canal near structure S-178. Although this historical data indicates elevated levels at this location, data collected between 2001 and 2009, by the NFS, at the same location (from within the C-111-E canal near structure S-178) indicated only a single minor exceedance of endosulfan (0.057 µg/L) of the 0.056 µg/L State standard for Class III waters for total endosulfan.

More importantly from the project perspective, total endosulfan data collected between 1993 and 2009 from the C-111 Canal near structure S-177, which is representative of the project's source water, indicated no exceedances of the 0.056 µg/L State standard for Class III waters for total endosulfan. Water supplied to the Frog Pond Detention Area and to the Aerojet Canal will originate upstream of S-177.

While the source water currently meets the .056 µg/L State standard for Class III waters for total endosulfan, it is believed that endosulfan concentrations will decrease even further over time as a result of conversion of private lands to conservation, implementation of better management techniques, and a reduction in the use of the older pesticide formulations.

#### 2.10.3 Mercury

Health advisories have been issued due to elevated mercury levels in freshwater and estuarine fish for many Florida waterbodies, including freshwater wetlands of ENP and Florida Bay. Mercury methylation is of primary concern since this is the process that transforms less toxic inorganic mercury (Hg) to the highly toxic and bioaccumulative methylmercury (MeHg). Sources of mercury to the biota of the Everglades and Florida Bay may include atmospheric deposition, runoff containing mercury, and internal mercury cycling between the sediments, the water column, and various organisms in the food chain.

#### 2.10.4 Salinity

The C-111 Basin drains into eastern Florida Bay via Taylor Slough and overland flows from the lower C-111 Canal. Florida Bay currently experiences salinity imbalances that might be caused, in part, by changes in the historic timing and quantity of freshwater deliveries from the C-111 Basin. The SFWMD is currently performing monitoring of salinity levels in Florida Bay.

To provide protection during large storm events, floodwater may be discharged from the lower C-111 Canal through S-197 into the Manatee Bay/Barnes Sound area of southern Biscayne Bay. Freshwater flood control discharges through the S-197 structure may, depending on the duration and total volume of the

discharges, cause negative local impacts due to rapid changes in salinity in Manatee Bay/Barnes Sound.

## 2.11 AIR QUALITY

Existing air quality in the affected environment is good to moderate except for the air pollutant ozone. Based on ten years of monitoring data, the national ambient air quality standard for ozone is periodically exceeded in the eastern urbanized coastal part of Dade County. The C-111 SC study area is situated in southern Dade County. Dade County is classified by the FDEP as Ozone Attainment/Maintenance Areas (i.e., meets all federal standards currently) (USACE, 2000).

Short-term occurrences of elevated levels of airborne particulate matter could occur periodically in the project area due to natural fires and limestone mining activities. Air pollution from the urbanized coastal area is also expected to affect the air quality of the project area. Existing major stationary sources in the south Florida area include an oil-fired power plant at Fort Myers (West Coast), oil-fired power plants and municipal waste incinerators in the eastern coastal areas of Palm Beach, Broward, and Dade counties, sugar cane processing mills near Clewiston and Belle Glades and a portland cement plant in western Dade County. Vehicle emissions are not significant, but contribute to air quality of the area (USACE, 2000).

The prevailing northeast winds carry emissions from the metropolitan areas and regional oil-fired power plants and waste incinerators into the project area. Regional haze and smoke plumes attributed to the power plants and sugar cane burn off have been observed in the adjoining Everglades area. Observations from Miami International Airport indicate a typical visual range of ten to fifteen miles (USACE, 2000).

The flat coastal and inland terrain, in combination with diurnal changes in temperature, land/sea breeze recirculation, and frequent south Florida afternoon thunderstorms, constantly alters the surface air flow over the C-111 SC area and provides for continuous air movement and circulation. These factors provide good dispersion rates. No areas or periods of prolonged or poor dispersion are expected in the affected environment (USACE, 2000).

The project area has been designated in the Clean Air Act (42 USC, 7472) as a Prevention of Significant Deterioration (PSD) Class II area for all EPA regulated air pollutants except ground level ozone. Industrial development is allowed within such areas provided the release of air pollutants associated with such development complies with the requirements of Ambient Air Quality, PSD, and Non-attainment New Source Review standards (USACE, 2000).

PSD Class I areas, including wilderness areas established prior to the enactment of the Clean Air Act in 1977, and national parks, have more stringent standards than the PSD Class II areas. ENP is designated as a Class I area (USACE, 2000).

## 2.12 HAZARDOUS, TOXIC, OR RADIOACTIVE WASTE

A Limited Phase I Environmental Site Assessments conducted over 6,770 acres within the proposed project footprint identified approximately 4,186 acres of former agricultural lands. Subsequent soil quality evaluations conducted on the former agricultural lands indicated that detectable levels of residual agrochemicals were present within portions of the former agricultural lands including barium, cadmium, chromium, copper, lead, zinc, 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, chlordane and endosulfan. As described in Annex B.2.2.3, all of these substances were present at concentrations well below federal or state regulatory levels for agricultural (commercial & industrial) land uses though there were some exceedances of FDEPs sediment quality assessment guidelines (SQAGs), which are typically used as screening values to determine the ecological implications of inundating project lands. In accordance with the jointly (USFWS, FDEP, and SFWMD) developed "Protocol for Assessment, Remediation, and Post-remediation Monitoring for Environmental Contamination on Everglades Restoration Projects" (SFWMD, 2008), lands which exceeded the SQAG for one or more parameters were then subjected to a Screening Level Ecological Risk Assessment (SLERA).

Based on the results of a screening level ecological risk assessment (SLERA), the USFWS concluded that hydration of the surficial soils within portions of former agricultural lands known as the Frog Pond posed potential risks to USFWS Trust Species (i.e., species protected by the Endangered Species Act or the Migratory Bird Treaty Act). Specifically, the USFWS concluded that 4,4-DDE, copper, and zinc pose a potential risk to the Snail Kite, and 4,4-DDE poses a potential risk to the Osprey.

## 2.13 CULTURAL RESOURCES

A review of the Florida Master Site Files indicated several known archaeological sites near the C-111 SC project area. Due to the existence of known historical properties, tree islands and the probability of unrecorded sites within the general vicinity that have the potential to be impacted by construction, a professional archaeological survey was recommended.

A Phase I cultural resources survey was conducted in the area of potential effect. The survey identified a single historic resource (8DA11433), a limestone road likely constructed in the 1930s. It is not considered eligible for the National Register of Historic Places. With the concurrence of the State Historic

Preservation Officer, the USACE has determined that the planned undertaking will have no effect on any significant cultural resources. This determination has been made in compliance with Section 106 of the National Historic Preservation Act of 1966 (PL 89-665), as amended; its implementing regulations (36 Code of Federal Regulations [CFR] Part 800) and the Archaeological and Historic Preservation Act of 1974 (PL 93-291), as amended.

## 2.14 SOCIOECONOMICS

This section includes a description of the local economy and demographics of the study area. This descriptive information provides insight into the study area's socio-economic characteristics, and provides part of the basis for different facets of the economic impact evaluation in the Alternative Effects chapter. The data obtained and analyzed is on a state, county and census tract basis, and was collected through the 2000 census. Due to the given geographic boundaries, some census tracts are only partially represented within the study area.

### 2.14.1 Population

The aggregated population of the relevant census tracts in the study area had a 2000 census population of 114,042. A corresponding figure from the 1990 census is unattainable because, due to population growth, the previous census tracts were subdivided to create the current tracts. Population in Miami-Dade County has increased 16.3 percent during the 1990 to 2000 period. The population of Florida and the United States increased 23.5 percent and 13.1 percent respectively over the same period.

Population in Miami-Dade County is expected to increase nearly 70 percent from 2000 to 2050. Despite this population growth, Miami-Dade County will fall short of the projected growth of the south Florida nine-county area, which is projected to grow at 78 percent between 2000 and 2050.

Miami-Dade County has a large percentage of people that claim Hispanic origin. Of the 2.25 million residents in the county during the year 2000, over one half are of Hispanic origin. Miami-Dade County comprises nearly half of the state's Hispanic population. Of the population in the study area, 44.7 percent claim Hispanic roots.

Florida's African-American population is 2,333,427, which is 14.5 percent of the state's total population. In Miami-Dade County the African-American population is 457,432, which makes up 20.3 percent of the county's population. The study area has a population that is 25.4 percent African-American (29,011 persons).

The Native-American population of the study area represents less than one percent of the aggregate population of the study area (577 persons).

#### 2.14.2 Economy

Generally, a strong wholesale and retail trade, government and service sectors characterize Florida's economy. Florida's warm weather and extensive coastline attracts vacationers and other visitors and helps make the state a significant retirement destination for people all over the country. Agricultural production is also an important sector of the state's economy, and is especially significant to portions of the study area. Compared to the national economy, the manufacturing sector has played less of a role in Florida, but high technology manufacturing has begun to emerge as a significant sector in the state over the last decade.

The three most significant employment sectors in the Miami-Dade economy are retail trade, administrative support and guest services (accommodation and foodservice). In 1997 retail trade in Miami-Dade County employed 110,292, administrative support employed 71,916 and guest services employed 75,597. These three top industries paid aggregate 1997 salaries of 1.99 billion, 1.32 billion and 88 billion respectively.

The unemployment rate for Florida is 3.9 percent (1999), while the unemployment rate for Miami-Dade County is 5.7 percent. Unemployment in the study area census tracts is reported as being considerably higher, at 10.2 percent, which represents 7,804 persons over the age of 16 that are in the labor force\*\*.

Personal per capita income in Florida is \$24,799 (1997), but is somewhat lower in Miami-Dade County, at \$21,688. The personal per capita income in the study area is lower than both the state and county levels, at \$13,591.

Despite having a considerably lower than average per capita income, the study area's median household income is comparable to that of the county and state. At \$36,477, it falls short of the state average (\$38,819) but higher than that of Miami-Dade County (\$35,966). These numbers suggest greater household size within the study area to account for the increased income. Current census data reports an average of 3.43 persons per household in the study area while the state and county average household sizes are 2.46 and 2.84 respectively.

In 1999 it was reported that 12.2 percent of Florida's population lived below the poverty level, while 17.6 percent of Miami-Dade County were below the poverty level. The percentage of individuals in the study area living below the poverty level is considerably higher, at 22.4 percent. Within the study area 40,611

individuals live below the poverty level while the state reports 1,952,629 and the county reports 369,995.

## 2.15 AGRICULTURE

Despite its continued population growth and urban expansion, agriculture in Miami-Dade County remains a valuable industry and employer.

In the 2002 Census of Agriculture, it is reported that the market value of agricultural products from Florida exceeded 6.2 billion dollars per year. Florida ranks number one nationally in sugar cane production and number one in the quantity of all nursery acres. Additionally, Florida ranks number two in fruit, nursery/greenhouse crop and vegetable production. Statewide, agriculture employs 118,531 individuals.

In Miami-Dade County there are 2,244 farms with total cropland of 90,373 acres. The market value of agricultural products sold in Miami-Dade County is over 573 million annually. There are 11,403 persons employed by agriculture in the county. \*\*\*

Because of the temperate climate, Miami-Dade County and south Florida are a major source of traditional vegetables for the rest of the nation during the colder months. Traditional vegetables include pole beans, tomatoes, squash, potatoes, corn, bell peppers, and other more common vegetables. For the 1997/1998 growing season, Miami-Dade County produced a traditional/winter vegetable harvest that had an estimated value of over 213 million dollars. Of these crops, the value sold outside Miami-Dade County was over 210 million (98 percent). Additionally, Miami-Dade County is the number one producer of nursery/greenhouse crops and the number one producer of sweet potatoes in the state.

Aside from the extended growing season of traditional crops, the climate of south Florida is favorable for the growth of many different tropical fruits. These fruits include lychee, avocado, mango, Persian limes, carambola, mamey sapote, guava, papaya, and bananas. Additional smaller yield tropical fruits are harvested as well. In 1997/1998 almost 13,000 acres were reported used for tropical fruit in the county. The estimated total value of the yield during that same time period was 73.5 million dollars, with nearly 87 percent sold outside Miami-Dade County.

## 2.16 STUDY AREA LAND USE

Current land uses include an alligator farm in the North C-111 Basin that also provides airboat tours in the adjacent wetlands. There is a rock mining operation between Card Sound Road and U.S. Highway 1 that is contiguous

with, but not part of, the management area. The U.S. Navy maintains two facilities east of Card Sound Road, one of which was recently placed on the surplus land list. FP&L has a mitigation bank for 13,000 acres of the management area east of U.S. Highway 1. Most of the land west of U.S. Highway 1, south of 424<sup>th</sup> Street, is owned by the SFWMD and is managed by the Florida Fish and Wildlife Commission (FWC) for environmental purposes and recreational uses as the SGWEA. The management area is subdivided by canals, plus associated levees and access roads, and roads for general transportation, and utility access. The management area is used for recreational activities such as birding, hunting, fishing, frogging, kayaking, canoeing, hiking and airboating.

\* Census tract data obtained through 2000 census. Due to the given geographic boundaries, some census tracts are only partially represented within the study area.

\*\* Employment data supplied by Bureau of Labor Statistics, 1999 annual data (to remain consistent with 2000 census data)

\*\*\* 2002 Agriculture data for employment and market value (both state and county level) were provided by the 2002 Census of Agriculture (USDA National Agricultural Statistical Service)

‡ Data provided by Miami-Dade County Agricultural Land Retention Study: Final Report (University of Florida, IFAS)

## 2.17 PUBLIC LAND MANAGEMENT

The C-111 SC project area includes large tracts of lands managed by several different public agencies and private companies. Specifically there are four major management areas. These include: 1) ENP to the west and southwest; 2) SGWEA situated between ENP and U.S. Highway 1; 3) the Southern Glades Addition, to the north of SGWEA; and 4) the Model Lands Project, east of U.S. Highway 1.

### 2.17.1 Everglades National Park

The ENP is managed by the NPS to maintain and restore natural habitat. Most of the park area within the project is high quality native vegetation including, marsh with tree islands and cypress domes, pine rockland, and coastal wetlands. The major management challenge is a very large area of dense exotic vegetation, predominately Brazilian pepper (*Schinus terebinthifolius*) and shoebuttton ardesia (*Ardesia elliptica*), found within an area referred to as the Hole-in-the-Doughnut. This is an approximately 4,000-acre area. Major restoration of this area, approximately 400 acres per year, for the past several years has been

completed. The restoration method consists of mechanical clearing of the vegetation and removal of the previously farmed soil layer down to the bare bedrock. This method has been successful in preventing reinvasion of exotic vegetation and has promoted native marsh species. The restoration has been paid for with dedicated funding from wetland permit fees collected through the Bird Drive Basin Special Area Management plan. At this time, it is not projected that future mitigation fees will be enough to complete the project.

The natural areas management within the park includes regular maintenance to control exotic plant species and an extensive use of prescribed burning to maintain and enhance the fire adapted communities making up the majority of the area.

#### 2.17.2 Southern Glades Wildlife and Environmental Area

The SGWEA consists of approximately 32,000 acres owned by the SFWMD and managed jointly by the SFWMD and the FWC. Like ENP, much of the area consists of high quality native wetland communities. The exceptions are the previously disturbed areas due to farming activities along the northwest boundary of the area. The result is nearly a monoculture of Brazilian pepper and shoebutton ardesia. In recent years, both agencies have begun activities to reduce the exotics. This has included mechanical clearing and replanting as well as herbicide applications. Future plans include test cells to find the most cost effective and ecologically beneficial way to deal with the problem. Addressing this problem will be one of the major long-term goals for the area. Prescribed burning is another management tool for the area. In the past few years the prescribed burning program has averaged several thousands of acres per year. This program is critical to preserving habitat and potential nesting success of the sub-population D of the CSSS as well as the ecosystem in general. Other regular management activities include gating and barriers to control illegal off road vehicle use, control and cleaning of illegal solid waste dumping and managing a public use program. Public use is overseen by the FWC according to the rules of the SGWEA. Activities include seasonal hunting, air boating, and frogging. Year around activities include birding, fishing and other wildlife viewing.

#### 2.17.3 Southern Glades Addition and Model Lands

The Southern Glades Addition and the Model Lands are managed similarly. The Southern Glades addition, sometimes referred to the North C-111 Addition is located south of the Florida City agricultural fields, east and north of SGWEA and west of U.S. Highway 1. The Model Lands include most of the non-agricultural lands between U.S. Highway 1 and Biscayne Bay, extending south to Card Sound and Barnes Sound.

The two areas together represent over 42,000 acres of land. Both the SFWMD and Miami-Dade County are jointly acquiring and managing land within the area. To date over 12,000 acres have been acquired. Due to the scattered ownership within the project area, limited management activities have taken place. The major activities over the past several years have been exotic vegetation control, solid waste removal, law enforcement patrols and the identification and marking of the larger acquired tracts. The posted signs close the area to public use until a large enough tract is acquired to safely support an ecologically compatible use. The current use is primarily by all-terrain vehicles (ATVs) for hunting and joy riding/mudding.

The county and the SFWMD have been working on a loose agreement to share management costs while a new acquisition and management plan is developed. Both sides have agreed at this time to have the SFWMD act as lead management agency and to split management costs, with in-kind services and cash from the county totaling 50 percent.

As with the Southern Glades, the major challenge in this area will be the exotic vegetation in the northern forested wetland fringe that was previously farmed. The large blocks of Brazilian pepper and other exotics will likely cost millions of dollars over many years to control.

## 2.18 ROADS AND OTHER BARRIERS TO SHEETFLOW

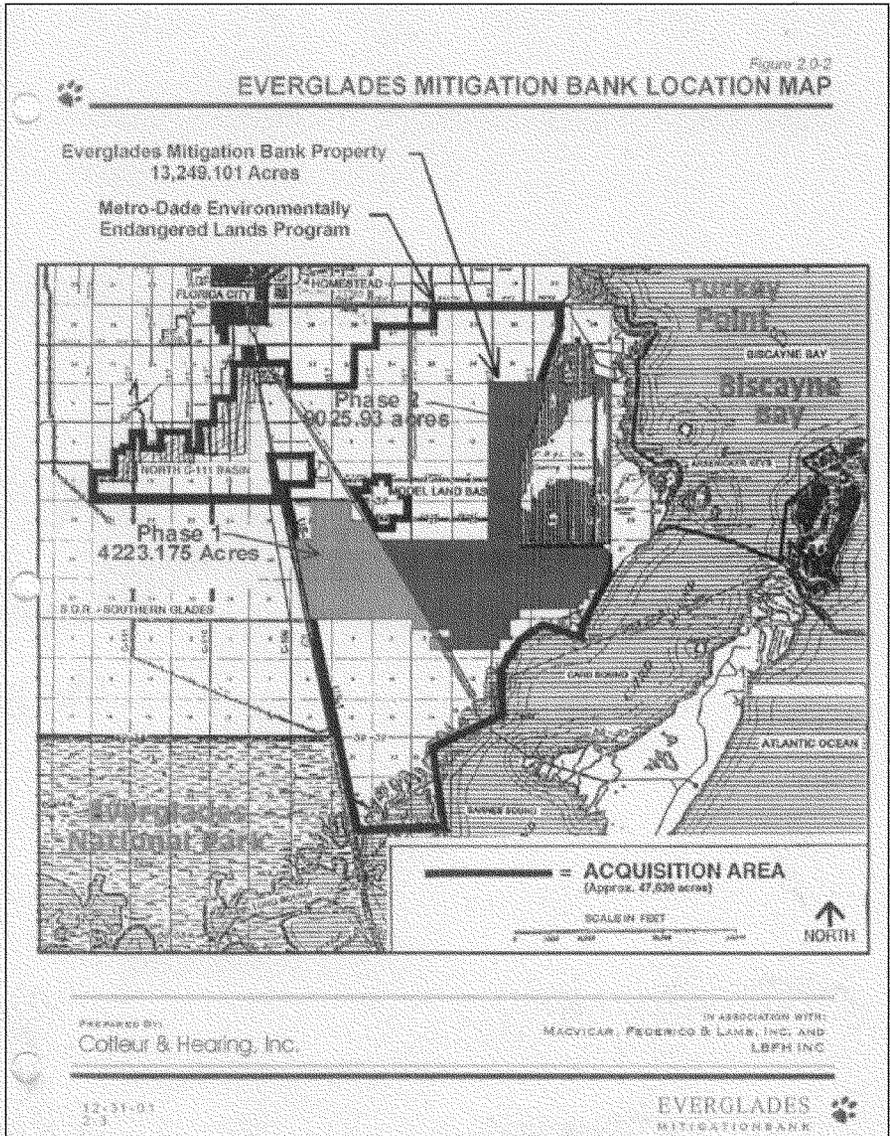
There are two major types of barriers to sheetflow: canals and their associated levees, and roads. The major canals in the project area that prevent sheetflow are the C-111 and Canal 110 (C-110) (*FIGURE 2-5*). There are several unnamed borrow canals in the project area. The major roads that prevent sheetflow are U.S. Highway 1, Card Sound Road, and Aerojet Road. The Florida Department of Transportation (FDOT) plans to modify U.S. Highway 1 by converting approximately twenty miles of road (from Key Largo north to the junction of U.S. Highway 1 and Card Sound Road) from a two-lane to a four-lane highway with nine box culverts and two wildlife crossings at certain locations. In the SGWEA, there are several old ditches, canals, roads and levees that act as hydrologic and ecologic barriers. In the Southern Glades Addition and Model Lands, there are many section and half section line roads as well as canals and ditches throughout the area. Many of these barriers could be removed to increase habitat continuity and sheetflow of water.



**FIGURE 2-5: MAJOR CANALS IN THE C-111 SPREADER CANAL PROJECT AREA**

## 2.19 MITIGATION PROJECTS

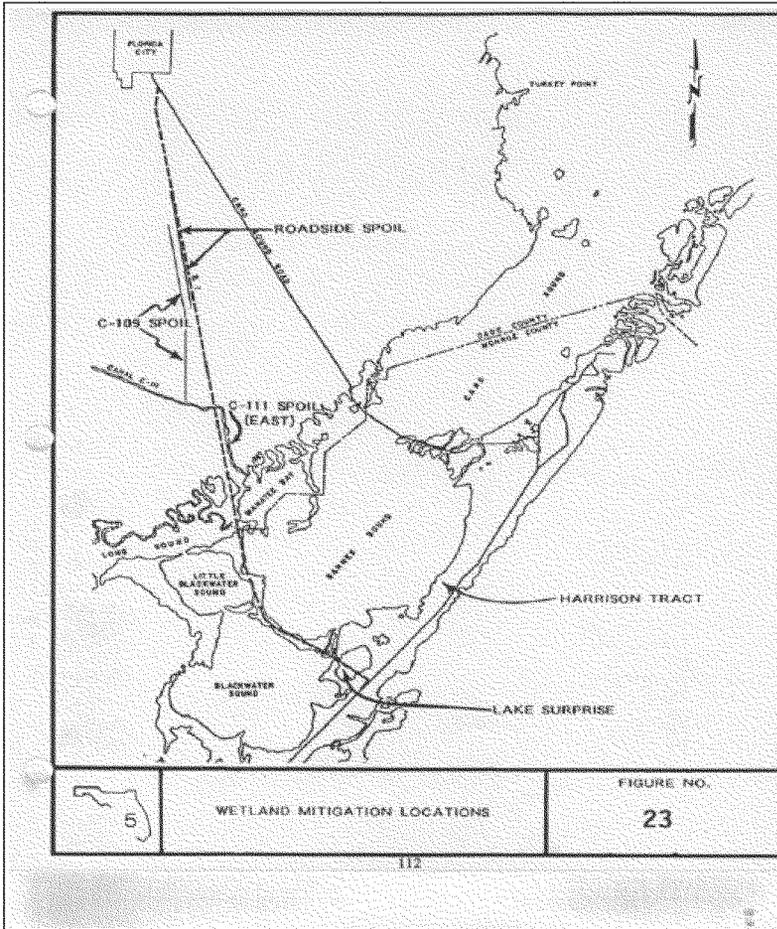
FP&L owns the Everglades Mitigation Bank (EMB), about 13,250 acres of wetlands, approximately five miles south of Florida City, just southwest of the Turkey Point Power Generation Facility and east of U.S. Highway 1, within the Model Lands (*FIGURE 2-6*). A conservation easement exists for the property. The primary goal of the EMB is to restore the site to reasonably approximate historic conditions. The mitigation bank consists of two phases, the first of which lies between U.S. Highway 1 and Card Sound Road and has been constructed. The first phase of EMB is composed of 4,223.18 acres of predominately freshwater sawgrass marsh and interspersed hardwood tree islands, and consisted of exotic vegetation (mainly Australian pine and Brazilian pepper) removal, replanting 16 acres of tree islands with native species, and removing Canal 108 and associated right of way to promote sheetflow of water. The second phase is currently pending construction permit authorization, and consists of exotic vegetation removal, removal of physical manmade features (dikes, roads, canals) within the 9,025.93 acres and replanting with native vegetation, and other hydrological improvements to restore the historic hydroperiod as much as possible.



**FIGURE 2-6: FLORIDA POWER AND LIGHT MITIGATION SITE MAP**

Atlantic Civil, Inc. has a mitigation area of 1,872 acres of wetland enhancement on the east side of Card Sound Road, between southwest 344<sup>th</sup> and southwest 408<sup>th</sup> Streets, as part of a Department of the Army permit. The mitigation consists of exotic vegetation removal.

FDOT maintains three mitigation sites within the project area, including Canal 109 (C-109) Spoil, Roadside Spoil area, and C-111 Spoil Area east of U.S. Highway 1 (*FIGURE 2-7*). The C-109 mitigation, a total of 82.2 acres, consisted of backfilling C-109 with the spoil banks (levees) flanking each side of the canal. Deep, open water refugia were left periodically along the length of the canal for wildlife. The Roadside Spoil mitigation (11.4 acres) consisted of scraping two and a half miles of spoil mounds (with exotic vegetation) along a roadside canal down to native soils, at an elevation approximately equal to the contiguous sawgrass prairie. The C-111 East mitigation consisted of removing spoil mounds and fill, resulting in 38.2 acres of sub-tidal wetland restoration (FDOT, 1992).



**FIGURE 2-7: FLORIDA DEPARTMENT OF TRANSPORTATION MITIGATION SITE LOCATION MAP**

## 2.20 RECREATION

The western portion of the proposed project area, and the primary focus of restoration activities, is composed of Everglades National Park (ENP) and the adjacent wetland areas east to the South Dade Wetlands. Taylor Slough in ENP is the main ecological feature located within the proposed project area

Everglades National Park was to be "...wilderness, (where) no development ... or plan for the entertainment of visitors shall be undertaken which will interfere

with the preservation intact of the unique flora and fauna of historic values the essential primitive natural conditions now prevailing in this area". Everglades National Park keeps track of the total number of visitors that enter the park through its two entrance stations (Homestead and Shark Valley), and the park has consistently maintained visitation rates of around 1 million persons a year since the late 1980's.

<b>Year</b>	<b>Recreational Visitors</b>
2008	822,118
2007	1,074,764
2006	954,022
2005	1,233,837
2004	1,181,355
2003	1,040,648
2002	968,909
2001	1,049,851

Airboat tours are available only through private operations along the Tamiami Trail, around Everglades City, and between Homestead and the Ernest Coe Visitor Center off route 9336. Deeper water boat tours and tram tours are also offered at several locations within the park. Personal watercraft are prohibited in Everglades National Park, and hunting is illegal in Everglades National Park.

The Southern Glades Wildlife Environmental Area is available for a variety of recreation uses. Motorized vehicles are prohibited in the area, with the exception that airboats may be used from December through March 1, and that outboard motor boats may be used within canals. The purpose of a wildlife and environmental area is to conserve and protect unique and irreplaceable wildlife habitats, restore areas to their original condition as much as possible, and provide controlled multiple recreational and educational uses consistent with this purpose. The management area is used for nature based recreational activities such as birding, hunting, fishing, frogging, kayaking, canoeing, hiking and airboating.

Fishing, within the C-111 Canal, is the primary recreational use within the SGWEA. Outboard motor boat, canoe, and kayak access is provided by an unimproved public boat ramp located on the C-111 Canal east of U.S. Highway 1. Bank fishermen can walk or bicycle into the area from SR 9336, U.S. Highway 1, southwest 424<sup>th</sup> Street, or Aerojet Road. A fishing platform and limited parking is provided on the L-31 Canal off of Aerojet Road.

A public use survey conducted from September through November in 1997 revealed a weekend use by the public that averaged seven people per day (unpublished GFC report 1998). After fishing, this survey found sightseers to be the most common user, followed by hunting, and biking. A foot trail has been established along the area's levees and horse gates have been installed to improve access for equestrian groups that wish to use the trail system. The C-111 Canal access road has been adopted as part of the Southern Glades Greenways Trail program, which from Manatee Bay north to SR 9336. It continues as the Everglades Greenways Trail from SR 9336 north to southwest 136<sup>th</sup> Street, along the C-111 Canal access road and the L31N Levee.

Fishing is permitted throughout the year within the SGWEA, while frogging is restricted to the period of December 1 through March 1. An annual deer season is open 30 days from early September through early October for archery hunters; three days in mid-October for muzzleloaders, and approximately 35 days from late October to late November for general gun hunting participants. However, due to low deer populations and limited access, hunter participation has been low. Game birds (ducks and snipe) may be taken during season established by the FWC for these species.

#### 2.21 NOISE

Within natural areas, external sources of noise are limited and of low occurrence. Rural areas have typical noise levels in the range of thirty-four to seventy decibels. Existing sources of noise outside of the rural communities are limited to vehicles that travel on U.S. Highway 1 and Card Sound Road (USACE, 2000).

#### 2.22 AESTHETICS

The natural areas are composed of a variety of wetland-based ecosystems including shrub marsh and vast expanses of sawgrass marsh and wet prairie, and tree islands. The land is very flat, with slight topographic rises on some tree islands. Much of the visible topographic features are from human development, including canals and levees. Views of much of the area offer pleasant perspectives of the Everglades and tree islands.

SECTION 3  
FUTURE WITHOUT PROJECT CONDITION

### 3.0 FUTURE “WITHOUT PROJECT” CONDITION

This project has been considered and studied as part of previous C&SF documents, such as the Canal 111 (C-111) South Dade County, Florida Integrated GRR and EIS, May 1994 and additional supplements added in 2002 and 2004. These documents contain information regarding system-wide existing conditions as well as conditions within the study area. These referenced materials will be expanded upon in this PIR through additional data collection efforts that will provide sufficient information to evaluate and compare alternative plans for the purpose of determining the Selected Plan. The collection of this additional data is currently underway. Discussion of existing conditions within the C-111 SC Western project study area, in the C-111 SC Western PIR, will comply with the NEPA of 1969 requirements for major federal actions. For planning purposes, the existing conditions are those that were in existence in December 2000 when Congress adopted the Comprehensive Plan.

The future without (FWO) plan condition describes the planning area’s future if no federal action is taken to solve the problem at hand. This condition is vitally important to the evaluation and comparison of alternative plans, and identifying impacts (both beneficial and adverse) attributable to proposed federal actions. This section provides a definition as to what is meant by future without plan condition, and how and why it is developed.

This section identifies the present status of various environmental, hydrological and social parameters within and adjacent to the project area and identifies trends and assumptions of those elements under a future without project scenario. The primary focus area is identified as the area in Figure 2-2 (Section 2), which is the area for which benefits were calculated. The adjacent areas were included to provide a comprehensive watershed perspective of existing to future without project conditions changes that could potentially influence alternative analysis.

### 3.1 “WITH AND WITHOUT” COMPARISONS

The U.S. Water Resources Council’s Principles and Guidelines provide the instructions and rules for federal water resources planning (USWRC, 1983). One Principles and Guidelines requirement is to evaluate the effects of alternative plans based on a comparison of the most likely future conditions with and without those plans in place. In order to make this kind of comparison, descriptions (often called forecasts) must be developed for two different future conditions: the future without project plan condition and the future with plan condition.

The future without plan condition describes what is assumed to be in place if a study’s alternative plans are not implemented. The without plan condition is

the same as the alternative of “no action” that is required to be considered by the federal regulations implementing the NEPA.

Future with plan conditions describes what is expected to occur as a result of implementing each alternative plan being considered in a study. With plan conditions are developed for each alternative plan; therefore, there are as many with plan conditions as there are alternative plans.

The differences between the without plan condition and the with plan condition are the effects or impacts of the plan. Note that the plan referred to in this context is any one of the alternative plans that have been considered in the C-111 SC Western project study process. The formulation and evaluation of alternative plans are described fully in *SECTION 5* of the PIR.

### 3.2 “WITH AND WITHOUT” VERSUS “BEFORE AND AFTER”

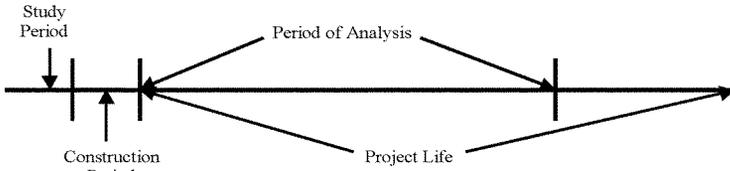
Many people typically think about the effects of alternative plans in terms of “before and after”; that is, they compare the condition that exists now or before it is changed by a plan, to the condition they expect will exist in the future after it has been changed by a plan. For example, if a proposed levee were to cover four acres of an existing ten-acre wildlife habitat, then using a before-and-after comparison, the levee could be said to result in a loss of four acres of that habitat.

Another way to think about effects is to compare expected future conditions if no alternative plan is implemented (the without plan condition), to expected future conditions if a particular plan is implemented (the with plan condition). Returning to the example, assume that the ten-acre wildlife habitat is already included in a residential development plan that would convert three of its acres to residential sites. Now suppose a proposed levee would cover four acres of the ten-acre site, including the same three acres that would be converted to residential sites. Using a with-and-without comparison, the levee would be said to result in a loss of only one acre since three of the four acres would be affected even if the levee were never constructed. With-and-without comparisons recognize that the future is often different from the existing condition; and unlike before-and-after comparisons, account for future changes in the comparison.

### 3.3 PLANNING HORIZON

The planning horizon encompasses the Feasibility Study period, construction period, economic analysis period, and the effective life of the project. The time frame used when forecasting future with and without plan conditions and while considering impacts of alternative plans is called the period of economic analysis. It may also be referred to as simply the period of analysis. It is the period of

time over which scientists think extending the analysis of the plan impacts is important. This time period is frequently confused with the planning horizon, which is a longer and more encompassing concept. *FIGURE 3-1* shows that the period of analysis is part of the planning horizon.



**FIGURE 3-1: PLANNING HORIZON**

The period of analysis for water resources projects usually falls between 50 and 100 years. Even if project structures last more than 100 years, there is too much inherent uncertainty to reliably forecast conditions and impacts beyond 100 years. One of the most common measures of impacts has to do with the time value of money. Future dollar values, whether benefits or costs, are worth less than current dollar values. Discounting is the process used to place dollar values incurred at different times on an equivalent time basis. After 50 years, the discount factor alone reduces monetary values to a mere fraction of their former value. Unless future dollar values being discounted are large, it is not beneficial to continue to include these values among project impacts.

The original base year of the proposed C-111 Spreader Canal Western Project in the AFB package was year 2014. Since that time, the non-federal sponsor has expedited their proposed construction plan to begin in year 2010. As such, the period of analysis for the proposed project was changed to 40 years, rather than 36 as indicated previously.

Although the typical period of analysis for a Civil Works project is 50 years, CERP projects differ because of the programmatic requirement to calculate system-wide benefits. As such, in order to accurately predict system needs and project operations for the entire system, all CERP projects utilize the most current version of the plan (i.e., the April 1999 “Final Integrated Feasibility Report and Programmatic Environmental Impact Statement” used 2050). Although future planning efforts may extend the end date of the period of analysis for later projects, the effort depends on the development of a new system-wide condition or update of the plan for project analysis. At this time, no new system-wide or plan condition has been developed. The following is referenced from CERP Guidance Manual Number 2:

“The Plan was based on a 50-year period of analysis and a planning horizon to the year 2050. The period of analysis for calculating the benefits and associated costs for a project will begin the year in which the project will be functional (base year). The end-point for the period of analysis used in a PIR will coincide with the period of analysis end-point used in the most current version of the Plan. This end-point consistency is necessary for the proper calculation of system-wide benefits. The PDT should note that this could result in a period of analysis shorter than 50 years. As periodic CERP updates are completed in accordance with section 385.31(c) of the Programmatic Regulations, the end point for the period of analysis will be revised to reflect the new condition.”

Intermediate points between year 2010 and 2050 were also utilized in the evaluation of alternatives for this PIR. These intermediate points were developed in order to predict the ecological response time of the Everglades in response to alternative implementation. This exercise is necessary for annualization of project benefits along with costs, which is then utilized in the Incremental Cost Analysis. The Analysis is a key tool that is used to compare alternatives and select a Recommended Plan. For this PIR, a single intermediate point of year 2020 was established for alternative response time, and is further documented in Section 5.9.4 of this PIR.

### 3.3.1 Forecasted Ecological Description/Setting

As a consequence of water management practices, land development, and sea level rise, undeveloped, freshwater wetlands in the C-111 SC project area have been reduced in functional value and aerial extent. Alterations of freshwater flow patterns and volumes have in particular reduced the occurrence of mesohaline, oligohaline, and freshwater marshes and sloughs, and have allowed the landward expansion of saltwater and mangrove wetlands, including low-productivity, sparsely vegetated dwarf mangrove communities typical of the hypersaline or white zone.

The spatial extent of the natural areas within the project study area has the potential to change through the year 2050. The main project areas under threat of development are located adjacent to existing developed lands. These project areas are typically composed of a myriad of private and publicly-owned lands. Numerous areas have been purchased for conservation by Miami DERM and the SFWMD; however, the majority of the conserved area is not connected and would not impede development further to the south. These areas are mainly purchased when money is available and when willing sellers are identified. As such, there is no particular pattern that would serve to separate the areas into some type of protected zones.

Currently, there are development permit applications pending for areas in the vicinity of the proposed project area. It is likely that development will be

permitted in these areas if all applicable environmental regulations are met; however, the rate and direction of urban expansion is extremely difficult to predict. As such, regulatory impacts were considered when compiling the future without project conditions. The future without land coverage used in the hydrologic modeling and benefit assessment assumed minimal loss of wetlands with new development occurring mostly on previously farmed lands. Under section 404 of the Clean Water Act permits are required for the discharge of dredge or fill material in waters of the United States including wetlands. Unavoidable impacts to wetlands or other aquatic resources require compensatory mitigation. There are some exemptions under the Clean Water Act for agricultural activities. Digging ditches and farming uplands does not require a permit so this activity could occur in the basin without any USACE permit. Clearing and filling for development would likely require a permit. In that situation, mitigation may be done on site through enhancement and preservation of existing wetlands or offsite. In addition, through the federal permit process the regulatory division of USACE evaluates compliance with other environmental laws such as Endangered Species Act (ESA).

The ESA and similar State regulations should serve to protect imperiled species of plants and animals in the area. Species Recovery Plans in existence are aimed at improving population levels of endangered species in the area. The plans should provide for an improvement in critical habitat function and also higher levels of reproduction and survival; however, even with the efforts of the FWS, there are still likely to be some negative effects on Endangered Species in the project area as a result natural climate and environmental occurrences such as alterations in rainfall patterns, hurricanes, fires, etc. Additionally, unregulated activities and secondary impacts from man-induced actions may reduce habitat potential in the proposed project area. Another protected resource in the proposed project area is EFH. The EFH in the proposed project area should continue in at least current levels of productivity in the Future Without Project condition; however, EFH, although regulated under the Magnuson-Stevens Fishery Conservation and Management Act, is also likely to experience some detriment in the project area due to the continued influence of previously constructed project features and also unregulated activities that affect such attributes as water quality. Effects on Florida Bay and other estuarine systems in the project area are often difficult to predict due to the dynamic nature of this type of environment; however, the current overall ecological trend in the area is shifted slightly downward. Any restoration activities or changes in local regulations for nutrient or run-off control could provide a positive shift in these trends in the future.

No effect on historical or archaeological resources in the project area is expected to occur under the Future Without Project conditions. Due to the remote location of the project area at the terminus of the Everglades system, cultural

resources in the area are more limited than in others that exist near substantial upland areas and human populations. Existing regulations should be sufficient to protect these resources from future impact.

The future without project condition assumptions also include the construction of the C-111 GRR features; however, the spreader canal feature was not included in the future conditions as it is currently being evaluated and is likely to be proposed under the C-111 SC Eastern project.

### 3.3.2 Water Management (Operations)

The current operating plan for the portion of the system that includes the C-111 Spreader Canal Western project area is the Interim Operational Plan (IOP); however, the IOP is due to expire in October 2010. A transitional operational plan, which may include modifications to the C-111 basin canal and detention area operations, is currently under development and anticipated to be implemented not later than October 2010.

The transitional operational plan is envisioned to be implemented in multiple phases, with this process ongoing until completion of the Modified Water Deliveries (MWD) Project, including the Conveyance and Seepage Control Features (CSCF) and Tamiami Trail Modifications. The development of a new, long-term regional operational plan for water management, to include the C-111 Spreader Canal Western project area, will subsequently be developed to integrate and optimize operations of the MWD and C-111 South Dade project features. The timeframe for development and implementation of the new plan is dependent on the planning and implementation schedule for the Modified Water Deliveries (MWD) project. At this time, it is anticipated that the new, long-term operational plan will be authorized and implemented within approximately three to five years. The new plan will either be the Combined Operational Plan (COP), or the Combined Structural and Operational Plan (CSOP), dependent on the selected method for evaluation of the MWD CSCF project features.

### 3.3.3 Flood Control

Flooding has always been a concern for all residents of Miami-Dade County. In the future, flooding would still occur despite millions of dollars in capital improvement projects from local, state and federal government. Many areas could still suffer flood damages in the future due to large storms that can overwhelm the local and regional water management systems.

With any agricultural-to-urban land use changes or possible loss of wetland function through unregulated activities, the number and saturation or inundation period of flooded areas may increase. Extremely low-lying areas that were developed prior to the implementation of the current flood criteria

standards would be particularly vulnerable to flooding unless action is taken by certain entities to bring these areas up to current standards for flood protection.

### 3.3.4 Forecasted Hydrologic Conditions

In general, the future-without project hydrologic conditions will provide a significant increase in the availability of water in the C-111 Basin relative to the existing conditions hydrology. This increase in available water is primarily due to the implementation of the Modified Water Deliveries project. A full description of the operational conditions that define the future-without hydrologic condition is provided below.

The hydrology of the C-111 Spreader Canal Western project future without project condition includes structural and operational modifications that will be made to the water management system as detailed in the 1993 General Reevaluation Report (GRR) for the MWD to ENP and the 1994 GRR for the C-111 South Dade project. The features of these projects will be installed upstream in the system to divert flows from L-31N and C-111 Canal to the Northeast Shark River Slough and Taylor Slough portions of ENP. Coastal salinity control structures will continue to operate in the future without project condition in accordance with the design operating criteria. Continued sea level rise may make it necessary to operate the canals at higher levels to avoid saltwater intrusion in the future. Also, point sources of freshwater discharge would continue through C-111 Canal to the estuarine systems of Manatee Bay and Barnes Sound.

Hydrology in the future without condition could be affected by land use changes. Previous CERP land use projections for the project area indicate that urban development will remain spatially constrained, and agricultural lands will increase only slightly. However, recent trends show that urban development, specifically residential land use, may increase significantly and that agricultural land use will decrease. The most recent 2050 land use projections were provided by Miami-Dade County for the C-111 SC Western future without project condition and included in the hydrologic modeling.

### 3.3.5 Water Supply Demands

An understanding of the future without project water supply demands is essential to understanding the amount of water available for the ecosystem restoration associated with the proposed C-111 SC Western project. In an effort to estimate existing water use and in order to predict the overall demands on the water supply in the year 2050, the USACE commissioned a report entitled M&I Water Use Forecasts, Initial Comprehensive Everglades Restoration Plan Update (2003). It is the contents of this report that provides the basis for the majority of the text that follows.

Within the aforementioned report, water use forecasts were developed for various sectors including public and self-supply domestic (residential), commercial, industrial, government, and unaccounted-for water loss. The M&I water use forecasts were developed using the IWR-MAIN Water Demand Management Suite, a computerized water resource planning tool that allows the development of water use forecasts and the evaluation of water conservation reports. Although IWR-MAIN runs and report are limited to M&I uses, water use in agriculture, mining, and power generation are addressed later within this text.

Within the report, M&I forecasts were provided for all or part of nine individual counties. In order to accurately project their needs, the counties were divided into a series of service areas. The proposed project area is wholly contained within the service area described as LECSA 3. Based on the foregoing, discussions regarding project relevant M&I water use forecasts will be limited to users within LECSA 3.

LECSA 3 consists of approximately all of the developed areas along the Atlantic Coast within Miami-Dade County and the Florida Keys portion of Monroe County. The Miami-Dade Water and Sewer Authority and the Florida Keys Aqueduct Authority, which serve most of the public supplied population in Miami-Dade and Monroe counties, were contacted to obtain water use data. The Miami-Dade Water and Sewer Authority sells water wholesale to communities within the county and retail to residential and commercial customers throughout the county. U.S. Geological Survey (USGS) water use estimates and monthly water use data for the retail customers of the Miami-Dade Water and Sewer Authority and the Florida Keys Aqueduct Authority were used to calibrate the IWR-MAIN models to the water use patterns of LECSA 3.

M&I water use for the LECSA 3 in 2000 was estimated at 373.2 million gallons per day (mgd) (which included 21.5 mgd for Monroe County). Under the “most-likely” scenario, by 2050, water use is projected to increase to 502.3 mgd (which includes 23.2 mgd for Monroe County). The most likely scenario includes the average University of Florida Bureau of Economic and Business Research (BEBR) population projections, coupled with average rainfall, and an assumption of compliance with currently enacted conservation measures. *TABLE 3-1* provides a breakdown of M&I baseline and conservation adjusted water use projections, in five (5) year increments, by sector. As shown in the table, for medium BEBR populations, the 2050 M&I water use projections range from a projected high of 622.8 mgd to a possible low of 404.1 mgd.

TABLE 3-1: LOWER EAST COAST SERVICE AREA 3  
M&I Baseline and Conservation Adjusted Water Use,  
Most-Likely Population Scenario, 2000-2050

Year	Sector	Baseline Water Use (MGD)			Conservation-Adjusted Water Use (MGD)		
		Dry	Wet	Annual	Dry	Wet	Annual
2000	Residential	236.0	233.0	234.8	236.0	233.0	234.8
	Commercial	72.9	71.3	72.2	72.9	71.3	72.2
	Industrial	7.1	7.1	7.1	7.1	7.1	7.1
	Government	6.9	6.9	6.9	6.9	6.9	6.9
	Unaccounted	52.6	51.8	52.2	52.6	51.8	52.2
	<b>Total Municipal</b>	<b>375.5</b>	<b>370.1</b>	<b>373.2</b>	<b>375.5</b>	<b>370.1</b>	<b>373.2</b>
2005	Residential	250.4	247.2	249.1	239.8	236.7	238.5
	Commercial	78.2	76.4	77.4	77.1	75.3	76.3
	Industrial	6.8	6.8	6.8	6.8	6.8	6.8
	Government	7.3	7.3	7.3	7.2	7.2	7.2
	Unaccounted	55.8	55.0	55.4	53.8	53.0	53.5
	<b>Total Municipal</b>	<b>398.5</b>	<b>392.7</b>	<b>396.1</b>	<b>384.7</b>	<b>379.0</b>	<b>382.3</b>
2010	Residential	266.6	263.2	265.2	246.0	242.7	244.6
	Commercial	83.4	81.6	82.6	81.2	79.4	80.5
	Industrial	6.5	6.5	6.5	6.4	6.4	6.4
	Government	7.8	7.8	7.8	7.5	7.5	7.5
	Unaccounted	59.3	58.4	58.9	55.5	54.7	55.2
	<b>Total Municipal</b>	<b>423.5</b>	<b>417.5</b>	<b>421.0</b>	<b>396.6</b>	<b>390.6</b>	<b>394.1</b>
2015	Residential	283.0	279.5	281.6	232.8	229.3	231.3
	Commercial	88.7	86.7	87.9	85.5	83.6	84.7
	Industrial	6.2	6.2	6.2	6.1	6.1	6.1
	Government	8.2	8.2	8.2	7.8	7.8	7.8
	Unaccounted	62.8	61.9	62.5	57.3	56.4	56.9
	<b>Total Municipal</b>	<b>449.0</b>	<b>442.6</b>	<b>446.3</b>	<b>409.4</b>	<b>403.2</b>	<b>406.8</b>
2020	Residential	297.3	293.6	295.8	238.5	234.9	237.0
	Commercial	94.1	92.0	93.2	89.9	87.9	89.1
	Industrial	5.9	5.9	5.9	5.7	5.7	5.7
	Government	8.7	8.7	8.7	8.1	8.1	8.1
	Unaccounted	66.1	65.1	65.7	59.0	58.0	58.6
	<b>Total Municipal</b>	<b>472.0</b>	<b>465.3</b>	<b>469.2</b>	<b>421.2</b>	<b>414.7</b>	<b>418.5</b>
2025	Residential	311.2	307.4	309.6	264.5	260.7	262.9
	Commercial	99.2	97.1	98.4	94.2	92.1	93.3
	Industrial	5.6	5.6	5.6	5.4	5.4	5.4
	Government	9.1	9.1	9.1	8.4	8.4	8.4
	Unaccounted	69.2	68.2	68.8	60.6	59.7	60.2
	<b>Total Municipal</b>	<b>494.3</b>	<b>487.4</b>	<b>491.5</b>	<b>433.0</b>	<b>426.3</b>	<b>430.2</b>
2030	Residential	324.1	320.2	322.5	270.1	266.2	268.5
	Commercial	104.0	101.7	103.0	98.0	95.9	97.1
	Industrial	5.3	5.3	5.3	5.1	5.1	5.1
	Government	9.5	9.5	9.5	8.7	8.7	8.7
	Unaccounted	72.1	71.1	71.7	62.1	61.2	61.7
	<b>Total Municipal</b>	<b>515.0</b>	<b>507.8</b>	<b>512.0</b>	<b>444.0</b>	<b>437.1</b>	<b>441.1</b>
2035	Residential	340.4	336.3	338.7	278.4	274.4	276.8
	Commercial	110.0	107.7	109.0	103.1	100.9	102.2
	Industrial	5.0	5.0	5.0	4.7	4.7	4.7
	Government	10.0	10.0	10.0	9.1	9.1	9.1
	Unaccounted	75.7	74.7	75.3	64.3	63.3	63.9
	<b>Total Municipal</b>	<b>541.2</b>	<b>533.7</b>	<b>538.1</b>	<b>459.7</b>	<b>452.5</b>	<b>456.7</b>
2040	Residential	356.9	352.6	355.1	287.2	283.1	285.5
	Commercial	116.1	113.6	115.1	108.3	105.9	107.3
	Industrial	4.6	4.6	4.6	4.4	4.4	4.4
	Government	10.5	10.5	10.5	9.5	9.5	9.5
	Unaccounted	79.4	78.3	79.0	66.6	65.6	66.2
	<b>Total Municipal</b>	<b>567.5</b>	<b>559.7</b>	<b>564.3</b>	<b>475.9</b>	<b>468.4</b>	<b>472.8</b>
2045	Residential	371.8	367.3	369.9	295.2	291.0	293.4
	Commercial	119.8	117.4	118.8	111.2	108.9	110.2
	Industrial	4.3	4.3	4.3	4.0	4.0	4.0
	Government	11.0	11.0	11.0	9.8	9.8	9.8
	Unaccounted	82.5	81.4	82.0	68.4	67.3	67.9
	<b>Total Municipal</b>	<b>589.4</b>	<b>581.4</b>	<b>586.1</b>	<b>488.6</b>	<b>481.0</b>	<b>485.4</b>
2050	Residential	386.9	382.3	384.9	303.6	299.2	301.8
	Commercial	126.9	124.2	125.8	117.4	114.8	116.3
	Industrial	4.0	4.0	4.0	3.7	3.7	3.7
	Government	11.5	11.5	11.5	10.1	10.1	10.1
	Unaccounted	86.1	84.9	85.6	70.8	69.6	70.3
	<b>Total Municipal</b>	<b>615.3</b>	<b>606.8</b>	<b>611.8</b>	<b>505.6</b>	<b>497.6</b>	<b>502.3</b>

Under the BEBR high population scenario, LECSA 3's annual average baseline M&I water use is projected to increase to 769.9 mgd (including 32.9 mgd for Monroe County) by 2050, while the high population annual average conservation-adjusted M&I water use is projected to increase to 622.8 mgd (of which Monroe County is projected to account for 30.2 mgd).

Under the BEBR low population scenario, LECSA 3's annual average baseline M&I water use is projected to increase to 483.3 mgd by 2050 (including 17.7 mgd in Monroe County), while the low population conservation-adjusted M&I water use is projected to increase to 404.1 mgd (of which Monroe County is projected to account for 16.4 mgd). It is important to note that while the per capita demand may be decreasing the overall water demands for the municipalities are increasing due to the expected population increases.

In addition to the scenarios described above, the IWR-MAIN model was used to project M&I water use during a one-in-ten year drought condition. As shown in *TABLE 3-2*, under the one-in-ten year drought scenario, the annual average M&I baseline water use is projected to increase from 373.2 mgd (in 2000) to 618 mgd by 2050 (including 25.4 mgd in Monroe County). M&I water use projections assuming compliance with water conservation measures are projected at 508.5 mgd by 2050, of which 23.5 mgd is projected for use in Monroe County. Conservation-adjusted water use projections are also presented within the table.

It is important to note that the M&I water use projections presented excluded self supplied (i.e. non municipal supplied) irrigation for agriculture, golf course, and landscaping, deep well withdrawals from the brackish Floridan Aquifer, and other non-consumptive uses. An example of the latter being water used in rock mining operations, which is generally returned immediately after use. In the case of Floridan Aquifer withdrawals, because they represent a withdrawal of the water far removed from the Everglades system, they are beyond the domain of the employed models, and will not be considered within this text.

Self-supplied landscape irrigation demand estimates for the entire LECSA are based on future land use maps developed for local government comprehensive plans, and are anticipated to increase by 48 percent to an average annual demand of 499,000 acre-feet. Similarly, self-supplied golf course irrigation within the LECSA is estimated to increase by 31 percent with average annual demand of 71,800 acre-feet.

Agricultural irrigation within the LECSA includes irrigation for row crops, citrus, tropical fruits and nurseries. Overall, most agricultural irrigation is expected to decline in the future with the exception of nursery irrigation, which is expected to increase. Total agricultural irrigation demands for the entire LECSA are estimated to decline by 28 percent to a total annual average demand

of 136,600 acre-feet. Nursery irrigation within the LECSA is estimated to increase by 164 percent to a total annual average demand of 52,900 acre-feet.

The increase in water demands do not necessarily equate to increased groundwater withdrawals or yield a greater demand on the water supply capability of the aquifer. The Lower East Coast Water Supply Plan is responsible for establishing future water resources for consumption and much of the future projections are not groundwater withdrawals, but instead alternate sources of water (desalinization, reservoir, canal water, etc...). The hydrologic modeling effort utilized the South Florida Water Management Model (2 X 2) 2050B3 boundary conditions and well pumping information. As mentioned in the previous section, the future-without project hydrologic conditions will provide a significant increase in the availability of water in the C-111 Basin relative to the existing conditions hydrology, due to the Modified Waters Deliveries project.

**TABLE 3-2: LOWER EAST COAST SERVICE AREA 3**  
M&I Baseline and Conservation Adjusted Water Use,  
1-10 Year Drought with Most-Likely Population Scenario, 2000-2050

Year	Sector	Baseline Water Use (MGD)			Conservation-Adjusted Water Use (MGD)		
		Dry	Wet	Annual	Dry	Wet	Annual
2000	Residential	236.0	233.0	234.8	236.0	233.0	234.8
	Commercial	72.9	71.3	72.2	72.9	71.3	72.2
	Industrial	7.1	7.1	7.1	7.1	7.1	7.1
	Government	6.9	6.9	6.9	6.9	6.9	6.9
	Unaccounted	52.6	51.8	52.2	52.6	51.8	52.2
	<b>Total Municipal</b>	<b>375.5</b>	<b>370.1</b>	<b>373.2</b>	<b>375.5</b>	<b>370.1</b>	<b>373.2</b>
2005	Residential	254.2	251.0	252.9	243.7	240.5	242.3
	Commercial	78.0	76.3	77.3	76.9	75.2	76.2
	Industrial	6.8	6.8	6.8	6.8	6.8	6.8
	Government	7.3	7.3	7.3	7.2	7.2	7.2
	Unaccounted	56.4	55.6	56.0	54.4	53.6	54.1
	<b>Total Municipal</b>	<b>402.7</b>	<b>397.0</b>	<b>400.3</b>	<b>388.9</b>	<b>383.2</b>	<b>386.6</b>
2010	Residential	270.6	267.3	269.2	250.0	246.7	248.7
	Commercial	83.2	81.4	82.5	81.1	79.3	80.3
	Industrial	6.5	6.5	6.5	6.4	6.4	6.4
	Government	7.8	7.8	7.8	7.5	7.5	7.5
	Unaccounted	59.9	59.1	59.6	56.1	55.3	55.8
	<b>Total Municipal</b>	<b>428.1</b>	<b>422.0</b>	<b>425.5</b>	<b>401.1</b>	<b>395.2</b>	<b>398.6</b>
2015	Residential	287.3	283.8	285.9	257.1	253.6	255.7
	Commercial	88.5	86.5	87.7	85.3	83.4	84.5
	Industrial	6.2	6.2	6.2	6.1	6.1	6.1
	Government	8.2	8.2	8.2	7.8	7.8	7.8
	Unaccounted	63.5	62.6	63.1	58.0	57.1	57.6
	<b>Total Municipal</b>	<b>453.8</b>	<b>447.4</b>	<b>451.1</b>	<b>414.2</b>	<b>408.0</b>	<b>411.6</b>
2020	Residential	301.8	298.1	300.2	263.0	259.4	261.5
	Commercial	93.9	91.8	93.0	89.7	87.7	88.9
	Industrial	5.9	5.9	5.9	5.7	5.7	5.7
	Government	8.2	8.2	8.2	7.8	7.8	7.8
	Unaccounted	66.7	65.8	66.5	59.6	58.7	59.2
	<b>Total Municipal</b>	<b>476.4</b>	<b>469.8</b>	<b>473.7</b>	<b>425.8</b>	<b>419.3</b>	<b>423.1</b>
2025	Residential	315.9	312.0	314.3	269.1	265.4	267.6
	Commercial	99.0	96.9	98.1	93.9	91.9	93.1
	Industrial	5.6	5.6	5.6	5.4	5.4	5.4
	Government	9.1	9.1	9.1	8.4	8.4	8.4
	Unaccounted	69.9	68.9	69.5	61.3	60.4	60.9
	<b>Total Municipal</b>	<b>499.5</b>	<b>492.6</b>	<b>496.6</b>	<b>438.2</b>	<b>431.5</b>	<b>435.4</b>
2030	Residential	329.0	325.0	327.3	274.9	271.1	273.3
	Commercial	103.7	101.5	102.8	97.8	95.7	96.9
	Industrial	5.3	5.3	5.3	5.1	5.1	5.1
	Government	9.1	9.1	9.1	8.4	8.4	8.4
	Unaccounted	72.8	71.8	72.3	62.9	61.9	62.5
	<b>Total Municipal</b>	<b>519.9</b>	<b>512.7</b>	<b>516.9</b>	<b>449.1</b>	<b>442.1</b>	<b>446.2</b>
2035	Residential	345.5	341.3	343.7	283.5	279.5	281.8
	Commercial	109.8	107.5	108.8	102.9	100.7	102.0
	Industrial	5.0	5.0	5.0	4.7	4.7	4.7
	Government	10.0	10.0	10.0	9.1	9.1	9.1
	Unaccounted	76.5	75.5	76.1	65.1	64.1	64.7
	<b>Total Municipal</b>	<b>546.8</b>	<b>539.3</b>	<b>543.6</b>	<b>465.3</b>	<b>458.1</b>	<b>462.3</b>
2040	Residential	362.1	357.8	360.3	292.4	288.3	290.7
	Commercial	115.8	113.4	114.8	108.0	105.7	107.1
	Industrial	4.6	4.6	4.6	4.4	4.4	4.4
	Government	10.5	10.5	10.5	9.5	9.5	9.5
	Unaccounted	80.3	79.2	79.8	67.4	66.4	67.0
	<b>Total Municipal</b>	<b>573.4</b>	<b>565.5</b>	<b>570.1</b>	<b>481.7</b>	<b>474.2</b>	<b>478.6</b>
2045	Residential	377.2	372.8	375.4	300.7	296.4	298.9
	Commercial	121.2	118.8	120.2	112.5	110.2	111.5
	Industrial	4.3	4.3	4.3	4.0	4.0	4.0
	Government	11.0	11.0	11.0	9.8	9.8	9.8
	Unaccounted	83.6	82.5	83.1	69.5	68.4	69.0
	<b>Total Municipal</b>	<b>597.3</b>	<b>589.3</b>	<b>594.0</b>	<b>496.5</b>	<b>488.9</b>	<b>493.3</b>
2050	Residential	392.3	387.9	390.0	309.3	304.9	307.4
	Commercial	126.6	124.0	125.5	117.1	114.6	116.0
	Industrial	4.0	4.0	4.0	3.7	3.7	3.7
	Government	11.5	11.5	11.5	10.1	10.1	10.1
	Unaccounted	87.0	85.8	86.5	71.6	70.5	71.2
	<b>Total Municipal</b>	<b>621.5</b>	<b>613.1</b>	<b>618.0</b>	<b>511.9</b>	<b>503.8</b>	<b>508.5</b>

### 3.4 AFFECTED ENVIRONMENT

This section defines the present status of various environmental parameters within and adjacent to the project area and identifies trends and assumptions of those elements under a future without project scenario. The primary focus area is identified as the area for which benefits were calculated. The adjacent areas were included to provide a comprehensive watershed perspective of existing to future without project conditions changes that could potential influence alternative analysis.

*TABLE 3-3* below summarizes the differences between the existing conditions and the future without project conditions on project lands for other environmental conditions. A more comprehensive narrative on those conditions is presented in *APPENDIX C - Environmental Information*.

TABLE 3-3: EXISTING VERSUS FUTURE WITHOUT PROJECT CONDITIONS ON C-111 SPREADER CANAL PROJECT LANDS

Resources	Existing Condition	Future Without Project Condition
Vegetative Communities	<p>The primary factors influencing the distribution of vegetation in this region are hydropattern, salinity, previous disturbance and to a lesser extent, nutrient loading and soil type. The dominant vegetation community in the region is a matrix of sawgrass prairie with tree islands. The tree islands vary in vegetation composition, depending upon elevation. At the highest elevation the sawgrass prairie alternates with forested wetlands. At the lowest elevations near the coast, mangroves replace the freshwater wetlands. The transition zone between the mangroves and the freshwater prairie is a needle rush-salt grass zone on the freshwater side, but stunted scrub mangrove on the coastal side. The plant community types present in the SDWMA include sawgrass glades, spike rush and beak rush flats, mulhy prairie, cypress stands, native dominated forested wetlands, tree islands, mangrove flats, hydric hammocks and exotic-dominated forests.</p>	<p>Possible future development, changes in availability and distribution of freshwater, and further disruption of natural sheet flow from discontinuities in hydrology due to possible construction of levees, roads, canals, etc. could exacerbate the changes occurring in the natural sawgrass, marl prairie, tree island, and mangrove ecotones. The shrub-dominated freshwater marsh east of Card Sound Road would not exist as a natural area. Freshwater wetlands in the northern project area could transition from a sawgrass-dominated marsh to cattail-saltbush-dominated wetlands due to poor water quality from residential runoff and decline of available freshwater. Sea level rise would create the potential for further expansion of salt tolerant plant species into the freshwater marsh areas. Disruption of natural fire cycles and extent can have several effects that would increase in the future without project scenario. Reduction of water availability can cause fires to burn more intensely than natural, killing plant species that would normally survive a more natural "cool burning" fire as well as permitting organic soils to burn. All of these processes would be exacerbated by any increased urbanization in the future.</p>
Fish & Wildlife Resources	<p>A total of forty-five fish species, fourteen amphibian species, forty-six reptilian species, fourteen mammalian species, and 178 avian species have been documented to occur in the SDW. In a conservative estimate, at least thirty-six state or federally listed animal species utilize the SDW, including fourteen federal listed species and nine state listed species potentially occurring in the project area.</p>	<p>Declining environmental trends from existing C&amp;SF project drainage structures would continue to cause stress on the ecosystem. As such, a reduction of the wetland function and value of coastal and inland habitats within and adjacent to the C-111 SC Western project study area are likely to continue. These effects on the wetland areas severely impact fish and wildlife</p>

		resources, reducing breeding potential of native species and encouraging the colonization by exotics. Although regulated, secondary and unforeseen effects from possible development and land conversion is also likely to result in an overall loss of fish and wildlife resources within the project area in the future. Disruption of the natural hydrology has already resulted in aquatic vegetation community changes and a resultant disruption of aquatic productivity and function that has had repercussions throughout the food chain including wading birds, raptors, larger predatory fishes, reptiles (crocodiles and alligators), and mammals. These effects are likely to continue and probably worsen over the next 40 years.
Non-Native Wildlife (Exotic Vegetation?)	Invasive species present in the SDWMA include melaleuca ( <i>Melaleuca quinquenervia</i> ), Australian pine ( <i>Casuarina</i> spp.), and Brazilian pepper ( <i>Schinus terebinthifolius</i> ), among others. The heaviest impacts from invasive species tend to occur in disturbed areas within the SDWMA, such as abandoned farmland and lands in the immediate vicinity of roads and berms. Such areas are frequently dominated by nearly monotypic stands of invasive plants. Elsewhere, these invasive plants are present in smaller, but no less important numbers in tree islands, marshes, and mangrove forests as a result of long distance seed dispersal. In other regions of the county, such outlier populations have rapidly expanded to create additional problems when left untreated.	An increased coverage of exotic vegetation associated with continued land disturbances and projected lower water levels is anticipated in a 40-year future-without project scenario. Invasive plant species such as melaleuca ( <i>Melaleuca quinquenervia</i> ), Australian pine ( <i>Casuarina</i> spp.), and Brazilian pepper ( <i>Schinus terebinthifolius</i> ) would become more widespread. Increases in runoff could subject marsh areas to higher levels of phosphorus, leading to the invasion and spread of cattail which reduces habitat quality and marsh and aquatic wildlife species diversity. Any increases in urbanization could lead to habitat change through anthropogenic effects (pets, exotic species releases, and wildlife mortality), further increasing the numbers of non-native exotics in the Everglades.
Threatened & Endangered Species	The FWS (2008) has determined that twenty-one federally listed threatened and endangered species and one species of similar appearance may occur within the project area that could be affected by a proposed action. In addition, the project area includes areas of designated critical habitat for	Existing regulations such as the Endangered Species Act and similar State regulations should be sufficient to preserve the continued existence of endangered species of plants and animals in the proposed project area. There may be some negative effect as a result of

	<p>the American crocodile, the Everglade snail kite, the West Indian manatee, the CSSS, elkhorn coral, and staghorn coral. Table 3 provides a list of federal and state-listed species.</p>	<p>unregulated activities and unforeseen secondary impacts of development projects in the area.</p>
Essential Fish Habitat	<p>The project is located in areas designated as EFH for corals and live bottom habitat, red drum (<i>Sciaenops ocellatus</i>), shrimp, spiny lobster (<i>Panulirus argus</i>), other coastal migratory pelagic species and the snapper-groupers complex. Specifically, EFH in Florida Bay is comprised of seagrasses, estuarine mangroves, intertidal flats, estuarine water column, live/hard bottoms, and coral reefs.</p>	<p>The Magnuson-Stevens Fishery Conservation and Management Act should be sufficient to maintain existing fisheries in the proposed project area. Some negative effects to active fisheries in the area may occur as a result of unregulated agricultural run-off and other type of secondary effects.</p>
Climate (Sea Level Rise)	<p>The climate of the project study area is considered subtropical, with distinct wet and dry seasons, high rates of ET, and climatic extremes of floods, droughts, and hurricanes. This climate represents a major physical driving force that sustains the Everglades while creating water supply and flood control issues in the agricultural and urban segments. Of the 53 inches of rain that south Florida receives annually on the average, 75 percent falls during the wet season months of May through October. Multi-year high and low rainfall periods often alternate on a time scale approximately on the order of decades. The mean annual temperature for the southern Everglades is 76°F (24°C). Various sites along the east coast of Florida indicate that the sea level is rising at a rate above the global average, at 8.85 inches over the last 100 years (Maul and Martin, 1993). If there would be an increase in saltwater intrusion into the well fields in the project area and salt-tolerant (coastal) vegetation could move further inland.</p>	<p>Hydrologic data used for both the existing and future without plan conditions were based upon an eight-year period, 1988-1995. Wet years were considered to be 1994-1995, dry or drought years were 1988-1989, and a typical, average year was 1992-1993. This period of record used for modeling is assumed to represent conditions that are expected to occur in the study area in the future. The potential problem concerning future climatic forecasts is sea level rise. Sea level rise of approximately 24.4 centimeters (9.6 inches) is forecasted for 2050 resulting in many affects to the overall system. Some examples of the impacts in a future without scenario would be continual creeping of saltwater inland, water supply, and flood protection, by raising the groundwater system.</p>
Hydrology	<p>The existing condition hydrology is characterized by limited water deliveries to Taylor Slough as well as the Panhandle of Everglades National Park. Nearshore salinity conditions</p>	<p>Under the future without condition, additional water deliveries would be provided to the C-111 Basin as a result of the Modified Water Deliveries (MWD)</p>

	<p>in Joe Bay, Little Madiera Bay, Long Sound, Barnes Sound, and Manatee Bay are elevated much of the year as a result of less than adequate freshwater flow deliveries. Flood event openings of the S-197 structure provide freshwater flows to Barnes Sound and Manatee Bay; however, the large flow volumes cause rapid and ecologically harmful swings in salinity within these two estuarine water bodies. Wetland vegetation in Taylor Slough receives too little water during critical dry season periods while receiving excessive water during wet season flood events. This altered hydrology continues to cause a shift in vegetation within Taylor Slough and the Panhandle from grammannoid wetlands to woody vegetation in some places.</p>	<p>project. The additional water to the L-31W and C-111 is reflected in slightly higher groundwater stages as well as higher flows through the S-176 and S-332D structures. Freshwater wetland vegetation and associated habitat functions should benefit from the additional water to the extent that this water is delivered at the appropriate time of the year. Since the MWD project does not include features south of the S-176 structure, the proportional distribution of flows between Taylor Slough and the Panhandle will likely be similar to that which exists under the present hydrologic conditions. Thus, Taylor Slough is likely to experience a less than optimal share of the available water while Barnes Sound/Manatee Bay are likely to experience continued releases from S-197 resulting in undesirable sharp salinity swings.</p>
<p>Landscape, Geology and Soils</p>	<p>South Florida is underlain by Cenozoic-age rocks to a depth of approximately 5,000 feet below land surface and is comprised of various percentages of sand, limestone, clay and dolomite. The marl soils found within the project area are typically characterized as silts with high concentrations of lime. The marl soils form under shallow water conditions and represent an important constituent of the whole ecosystem. Marl soils typically have standing water for short periods of time and are associated with thick algal mats and periphyton. Eleven of the thirteen soil types located in the area are classified as being wetland soils.</p>	<p>Based on current land use indicators, the landscape of the project area would be developed consistent with the surrounding land use patterns. While the majority of development is expected to occur on previously farmed lands, as a result of potential development to some limited wetlands, some wetland soils located in the area could be altered. Wetland soils would be drained and/or displaced with fill materials to support the urban development.</p>
<p>Water Quality</p>	<p>Water quality of the lower C-111 Basin has been affected by upstream pollution loadings and changes in water delivery system changes. The May 1994 GRR mentioned mercury and nutrients as the greatest threats to water quality in the region. Currently, elevated mercury levels are still a concern. Ongoing studies increasingly identify global atmospheric loading as the likely source of regional mercury</p>	<p>Factors contributing to the decline in future water quality conditions are probable increased runoff due to the conversion of agricultural lands to residential developments, and increased demand on the Biscayne Aquifer, which will reduce the dry season canal base flows. A change in the timing and magnitude of freshwater discharges to the nearshore areas could</p>

	contamination; redistribution of that mercury into areas could have a significant effect. Nutrients, total suspended solids, pesticides and to some extent, salinity have become the primary focus of water quality protection efforts in the southern Everglades region.	increase the duration of hyper saline conditions thus exacerbating the impacts to estuarine communities. Factors that would contribute to improved water quality are the reduction of agricultural related nitrite/nitrate loads, and the deployment of storm-water treatment controls built as part of new developments.
Air Quality	Existing air quality in the affected environment is good to moderate except for the air pollutant ozone. Based on ten years of monitoring data, the national ambient air quality standard for ozone is periodically exceeded in the eastern urbanized coastal part of Dade County. Dade County is classified by the FDEP as Ozone Attainment/Maintenance Areas (i.e., meets all federal standards currently) (USACE, 2000).	It is anticipated that significant number of small emission sources would be created over the next several decades as the land is developed. It is difficult to predict future air emissions generated because greater development and pro-business pressures may force this land to be used to meet the ever increasing expansion needs of Miami.
Hazardous, Toxic & Radioactive Waste (HTRW)	An extensive review of potential HTRW impacts in the project area has been performed. Numerous regulatory databases have been reviewed, cleanup actions at past industrial sites have been documented, and Phase I and Phase II Environmental Site Assessments have been performed. Although no contaminants were determined to be present at concentrations which would violate Federal or State Standards for agricultural (commercial & industrial) land use, the USFWS concluded, based on the results of a screening level ecological risk assessment (SLERA), that hydration of the surficial soils in the Frog Pond posed potential risks to two of their Trust Species, the Snail Kite and Osprey.	<p>The Future w/o project condition would appear to allow the project lands to continue to be farmed without consideration to the presence of residual agrochemicals. In this scenario, the soils would likely be exposed to additional agrochemical application which, despite improved farming practices, could increase residual soil chemical concentrations.</p> <p>Should the Non-Federal Sponsor, or a subsequent owner, opt to change the land use to something other than commercial or industrial they would have to meet all applicable federal and state regulatory levels for that land use, which may or may not require remediation of residual agrochemicals.</p> <p>Unauthorized disposal of solid waste on vacant land could increase and small amounts of hazardous or toxic wastes may be introduced into the environment. Industrial activities could also expand into the area if</p>

		the land is not reserved for environmental restoration purposes, but current environmental regulations should minimize future environmental impacts.
Cultural Resources	A review of the Florida Master Site Files indicated several known archaeological sites within the C-111 SC Western project area. Due to the existence of known historical properties, tree islands and the high probability of unrecorded sites within the general vicinity a professional archaeological survey is being conducted. Consultation with the Florida State Historical Preservation Officer is ongoing. This determination has been made in compliance with Section 106 of the National Historic Preservation Act of 1966 (PL89-665), as amended in 2000; it's implementing regulations (36 CFR Part 800) and the Archaeological and Historic Preservation Act of 1974 (PL93-291), as amended.	A review of the Florida Master Site Files indicated several known archaeological sites within the C-111 SC Western project area, which includes the site of Flagler Railroad. However, after a site visit to the project area and due the remote location of the C-111 SC Western project area, it is unlikely there would be any substantial negative effects to cultural resources under the Future Without Project condition..
Population	The 2000 census for Miami-Dade County indicates a population of 2,253,362. Of the 2.25 million residents in the county, over one-half is of Hispanic origin. The African-American population is 457,432, which makes up 20.3 percent of the county's population. The C-111 SC Western project site, however, has few permanent residents or existing businesses. The aggregated population of the relevant census tracts in the study area had a 2000 census population of 114,042. Of the population in the study area, 44.7 percent claim Hispanic roots, and 25.4 are African-American. The Native-American population represents less than one percent of the aggregate population of the study area.	Population in Miami-Dade County is expected to increase nearly 70 percent (1.5 million people) from 2000 to 2050. For lands within and adjacent to Miami-Dade County's Urban Development Boundary in the C-111 SC Western project study area, growth rates are projected to be very high. Due to this anticipated population growth, the county is expected to remain the most populated county in Florida. The dense urban area of the Lower East Coast of Florida has contributed to development pressure and population increases in Miami-Dade County. Miami-Dade County is expected to grow faster than the national trends until at least 2050.
Economy	The three most significant employment sectors in the Miami-Dade economy are retail trade, administrative support and guest services (accommodation and foodservice). The unemployment rate for Miami-Dade County is 5.7 percent. Unemployment in the study area	Future economic growth within the study area is expected to remain consistent with the population growth of the area, while maintaining a mix of service, retail and administrative jobs.

	<p>census tracts is reported as being considerably higher, at 10.2 percent, which represents 7,804 persons over the age of 16 that are in the labor force. The personal per capita income in the study area is lower than both the state and county levels, at \$13,591. Current census data reports an average of 3.43 persons per household in the study area while the state and county average household sizes are 2.46 and 2.84 respectively. The percentage of individuals in the study area living below the poverty level is considerably high, at 22.4 percent.</p>	
Agriculture	<p>Despite its continued population growth and urban expansion, agriculture in Miami-Dade County remains a valuable industry and employer. In Miami-Dade County there are 2,244 farms with total cropland of 90,373 acres. The market value of agricultural products sold in Miami-Dade County is over 573 million annually. There are 11,403 persons employed by agriculture in the county. Because of the temperate climate, Miami-Dade County and south Florida are a major source of traditional vegetables for the rest of the nation during the colder months. Aside from the extended growing season of traditional crops, the climate of south Florida is also favorable for the growth of many different tropical fruits.</p>	<p>Agriculture within the study is expected to remain a strong economic force in the study area, while conceding little to no ground to urban development. Using the South Florida Water Management Model (SFWMM) (2x2), it is determined that by 2050 agriculture will utilize 13,440 acres. Of this agricultural acreage, over 8,300 would be utilized for row crop production and over 5,100 would be utilized for citrus production. Additionally, ornamental tree nursery/farming would play a role as demand for these goods becomes more prevalent.</p>
Study Area Land Use	<p>The project area has multiple land uses. Current land uses include an alligator farm in the North C-111 Basin that also provides airboat tours in the adjacent wetlands. There is a rock mining operation between Card Sound Road and U.S. Highway 1 that is contiguous with, but not part of, the management area. The U.S. Navy maintains two facilities east of Card Sound Road, one of which was recently placed on the surplus land list. FP&amp;L has a mitigation bank for 13,000 acres of the management area east of U.S. Highway 1. There is a youth correctional institution west of U.S. Highway 1 at 424<sup>th</sup> Street. Most of the land west of U.S.</p>	<p>The Miami-Dade Comprehensive Plan (future conditions mapped from 2005 through 2015) depicts Homestead and Florida City as remaining a mix of low and medium-high density residential, business and office areas, and some industrial areas. The west and southwest of the two main residential areas would remain agricultural areas. The east would remain a mix of agriculture, industrial (extractive) and business. South of Florida City, with the exception of mining operations directly south of the urban areas would remain environmentally protected areas. The north</p>

	<p>Highway 1, south of 424<sup>th</sup> Street is owned by the SFWMD and is managed by the FWC for environmental purposes and recreational uses as the SGWEA.</p>	<p>and northwest would remain agricultural, while northeast is projected to maintain growth as a mix of residential, business and institutional. The SFWMM BLU (conditions through 2050), shows maintenance of the comprehensive plan land usage through 2050, with a higher population density in Florida City and Homestead. Although the comprehensive plans issued by each county are used to forecast future land use, these assumptions are subject to change. Additional build out for urban sprawl and changes in county planning policy usually require changes and modification in the long range planning forecast.</p>
Public Land Management	<p>The C-111 SC Western project area includes large tracts of lands managed by several different public agencies and private companies. Specifically there are four major management areas. These include: 1) ENP to the west and southwest; 2) SGWEA situated between ENP and U.S. Highway 1; 3) the Southern Glades Addition, to the north of SGWEA; and 4) the Model Lands Project, east of U.S. Highway 1.</p>	<p>It is expected that in the future without project scenario, land management within ENP, SGWEA, Southern Glades Addition, and Model Lands would continue in a similar way as the present time. Given the likelihood of further residential development, fire suppression, and degradation of water quality and quantity in the area, management practices might become increasingly concentrated on eradicating exotic plants, such as Brazilian pepper, shoebutton ardestia, and old world climbing fern. Land management practices in the SGWEA, Southern Glades Addition and Model Lands may also deal with restoration and law enforcement activities associated with further development to the north, including increased wetland disturbance due to illegal off road vehicle use, illegal solid waste dumping, and poaching.</p>
Barriers to Sheet Flow	<p>There are two major types of barriers to sheetflow: canals and their associated levees, and roads. The major canals in the project area that prevent sheetflow are C-111 and Canal 110 (C-110). There are several unnamed borrow canals in the project area. The major roads that prevent sheetflow are</p>	<p>In a future without project scenario, the current roads and barriers would exist and the wetland habitat would be significantly more degraded than in the existing conditions. U.S. Highway 1 would be a four-lane highway, but would have nine box culverts and two</p>

	<p>U.S. Highway 1, Card Sound Road, and Aerojet Road. The FDOI plans to modify U.S. Highway 1 by converting approximately twenty miles of road (from Key Largo north to the junction of U.S. Highway 1 and Card Sound Road) from a two-lane to a four-lane highway with nine box culverts and two wildlife crossings at certain locations. In the SGWEA, there are several old ditches, canals, roads and levees that act as hydrologic and ecologic barriers. In the Southern Glades Addition and Model Lands, there are many section and half section line roads as well as canals and ditches throughout the area. Many of these barriers could be removed to increase habitat continuity and sheetflow of water.</p>	<p>wildlife crossings to partially alleviate the impacts caused by widening this barrier.</p>
<p>Mitigation Projects</p>	<p>FP&amp;L owns the EMB, about 13,250 acres of wetlands, approximately five miles south of Florida City, just southwest of the Turkey Point Power Generation Facility and east of U.S. Highway 1, within the Model Lands. The primary goal is to restore the site to reasonably approximate historic conditions. Atlantic Civil, Inc. has a mitigation area of 1872 acres of wetland enhancement on the east side of Card Sound Road, between southwest 344<sup>th</sup> and southwest 408<sup>th</sup> streets, as part of a Department of the Army permit. The mitigation consists of exotic vegetation removal. FDOT maintains three mitigation sites within the project area, including Canal 109 (C-109) Spoil, Roadside Spoil area, and C-111 Spoil area east of U.S. Highway 1. The C-109 mitigation, a total of 82.2 acres, consisted of backfilling C-109 with the spoil banks (levees) flanking each side of the canal. The Roadside Spoil mitigation (11.4 acres) consisted of scraping 2.5 miles of spoil mounds at an elevation approximately equal to the contiguous sawgrass prairie. The C-111 East mitigation consisted of removing spoil mounds and fill, resulting in 38.2 acres of sub-tidal wetland restoration.</p>	<p>The mitigation projects in the area would continue to exist in the future without project scenario. The EMB would continue monitoring its 13,250 acres of wetlands. This area might be in better condition than as currently exists; however, this mitigation bank is not likely to reach its full restoration potential. The mitigation area currently maintained by Atlantic Civil, Inc., would probably have a degraded habitat compared with existing conditions, due to the probable development of the surrounding area. It may also be likely that the mitigation area itself is sold and subsequently undergoes residential and/or commercial development. The mitigation sites owned by FDOT would most likely exist as they are in the future without project scenario.</p>

Recreational Resources	SGWEA is used for a variety of recreational activities such as birding, hunting, fishing, frogging, kayaking, canoeing, hiking and air-boating. Fishing, primarily within C-111 Canal, is the primary recreational use within the SGWEA. After fishing, sightseeing is the most common use, followed by hunting and biking. A foot trail has been established along the area's levees and horse gates have been installed to improve access for equestrian groups that wish to use the trail system. The C-111 access road has been adopted as part of the Southern Glades Greenways Trail program.	As part of the without-project conditions, all of the regions in the State of Florida are expected to have significant increases in demands for the selected recreation activities with a commensurate need to increase development of the regions' recreation resources and facilities. Ecosystems support a significant amount of outdoor recreation in the Lower East Coast of Florida. A significant portion of the expenditures comes from tourists. Activities that are projected to have a lack of supply for recreation purposes are hiking, freshwater fishing and bicycle riding.
Noise	Within natural areas, external sources of noise are limited and of low occurrence. Rural areas have typical noise levels in the range of thirty-four to seventy decibels. Existing sources of noise outside of the rural communities are limited to vehicles that travel on U.S. Highway 1 and Card Sound Road (USACE, 2000).	Noise impacts are not likely to increase significantly in a future without project scenario.
Aesthetics	The natural areas are composed of a variety of wetland-based ecosystems including shrub marsh and vast expanses of sawgrass marsh and wet prairie, and tree islands. The land is very flat, with slight topographic rises on some tree islands. Much of the visible topographic features are from human development, including canals and levees. Views of much of the area offer pleasant perspectives of the Everglades and tree islands.	The C-111 SC Western study area has a diverse mix of urban, agricultural and wildlife conservation land uses. With an anticipated increase in urbanization, changes in the project area are expected to reflect population growth. Aesthetically, there would be more build-out with less open and agricultural lands in the future without scenario.

SECTION 4  
IDENTIFICATION OF PROBLEMS AND OPPORTUNITIES

#### 4.0 IDENTIFICATION OF PROBLEMS AND OPPORTUNITIES

##### 4.1 PUBLIC CONCERNS

An integral part of the identification of problems and opportunities is the knowledge and understanding of the public's concerns. A NEPA scoping letter was circulated May 7, 2002, requesting input from the public, local, state, and federal entities. The Notice of Intent for the proposed project was published in the Federal Register on May 16, 2002. A Scoping meeting was subsequently held in Miami-Dade Agricultural Center on May 22, 2002. The public was briefed on the status and initial formulation that was being conducted for the proposed project.

Numerous PDT meetings have been held throughout the development of this C-111 SC Western PIR. The PDT meetings included members of both the USACE and SFWMD, various stakeholders and members of the public. All public comments from the PDT meetings were documented and made available for dissemination.

##### 4.2 PROBLEMS AND OPPORTUNITIES

###### 4.2.1 Regional Ecological Problems

Natural resource specialists agree that the remaining ecosystems in south Florida no longer maintain the functions and richness that defined the pre-drainage system, and that these measures of ecological health will continue to decline without preventative actions. Not only is it certain that these natural systems will not recover their defining attributes under current conditions, it is unlikely that even the current, unacceptable ecological conditions can be sustained into the future. For example, wading birds, key indicators of broad, regional patterns of aquatic production, continue to show declines in the total number of birds initiating breeding in south Florida colonies. Other examples are the declines in population levels of commercially and recreationally important fish species in Biscayne and Florida Bays.

Many of the defining characteristics of the pre-drainage ecosystem (spatial extent, habitat heterogeneity, and dynamic storage) have either been lost or substantially altered as a result of land use and water management practices during the past 100 years in south Florida. Loss in spatial extent of natural areas has been most severe in the past 50 years with the construction of the C&SF project. Nearly half of the original Everglades ecosystem has been converted to agricultural and urban uses. The ecological effects of this loss in spatial extent include:

- Substantial reduction in habitat options for fish and wildlife
- Reduction in the system-wide levels of primary and secondary production
- Changes in the proportions of community types within the remaining system
- Degradation of water quality

The hydrology of the remaining Everglades has become altered by the operation of the C&SF project, which has generally:

- Reduced average annual flows and surface water stages;
- Lowered regional ground water tables;
- Created unnatural annual hydroperiods;
- Geographically-relocated long and short hydroperiod wetlands;
- Reduced the flooding periods of long hydroperiod refugia;
- Altered the frequency, duration and magnitude of inter-annual wet and dry cycles; and
- Altered salinity levels in estuaries.

Overall, the construction and operation of the C&SF project and its subsequent modification of the natural system has:

- Contributed to a substantial reduction in spatial extent of functional; habitat and ecosystem resiliency;
- Created a network of canals and levees that have accelerated the spread of exotic species;
- Greatly reduced the water storage capacity within the remaining natural system; and
- Created an unnatural mosaic of impounded and fragmented marshes throughout the natural system.

#### 4.2.2 Project-Specific Ecological Problems

Alterations in the natural system from the C&SF project and urban development have disrupted natural flow patterns and water stages in the C-111 Spreader Canal Western project study area. Specifically, these changes have resulted in the:

- Loss of the areal extent of freshwater wetlands;
- Reduction of foraging opportunities for natural fauna during seasonal drydowns;
- Alteration of historical flows via diversion through man-made canals;
- Conversion of freshwater, vegetative communities to salinity-dependent species as a result of saltwater intrusion ;
- Creation of a non-natural “white zone”;

- Colonization of natural areas by invasive, exotic species;
- Reduction of surface and groundwater flows to estuaries;
- Increase of hypersaline estuarine and nearshore areas leading to negative effects on nursery and juvenile fish habitat; and
- Degradation of water-quality from non-point source discharges.

#### 4.2.3 Regional Ecological Opportunities

##### 4.2.3.1 Spatial Extent

Scientists have identified the large spatial extent of the south Florida wetlands as one of the defining physical characteristics of the pre-drainage ecosystem. The size of the south Florida wetlands, in combination with the complex mosaic of habitats, enabled multiple populations of plants and animals to persist over time. The size of the pre-drainage area made it possible for the natural ecosystem to: 1) support genetically viable numbers and sub-populations of species with large feeding ranges and/or narrow habitat requirements, 2) provide the aquatic production to support large numbers of higher vertebrate animals in a naturally nutrient-poor environment and 3) sustain habitat diversity despite natural disturbances.

As of the present, roughly 50 percent of the pre-drainage wetland area and 90 percent of pinelands has been lost to development. The resulting loss of these natural areas has caused wading bird, snail kite, and panther populations to be stressed and reduced in number. Assuring adequate spatial extent for natural systems, necessary to support the mosaic of habitats characteristic of the pre-drainage ecosystem, will provide for genetically viable numbers and populations of native species and habitat diversity. Increasing viable habitat will lead to a proliferation of habitat diversity by expanding the dispersal options and augmenting the amount of seasonal refugia available for native species.

##### 4.2.3.2 Habitat and Functional Quality

Adverse changes have occurred in natural habitats such as sawgrass, mangroves, seagrass communities and other native wetland habitats in the south Florida ecosystems. A reduction in the quality of these areas has resulted in the loss of many or all of the functions that these areas historically performed. Improving the functional quality of the remaining natural areas is important to system-wide restoration given the loss of spatial extent and, thus, functions of the historic wetlands and uplands.

South Florida ecosystems are now substantially less productive and diverse than any time in history. For example, although many of the historic short hydroperiod wetlands no longer exist, wetlands that were historically much wetter now have short hydroperiods. Another example is the alteration of

wetlands in the Water Conservation Areas. The Areas were historically connected but are now managed as separate impoundments. As a result, aquatic productivity has been reduced and hydroperiods highly altered throughout the marshes of these Areas. Reductions in aquatic productivity have affected the abundance of birds as well as fish. Additionally, changes within these interior as well as coastal wetlands have adversely influenced downstream commercial fish and other species in coastal ecosystems such as Florida Bay.

Invasive plant and animal species have also impacted the quality of the south Florida landscape. Invasive species include both native (i.e. cattails) and non-native species (e.g. melaleuca, Brazilian pepper and Australian pine). The increasing dominance of any community by a single species ultimately reduces the habitat variability necessary to sustain a healthy community of both plants and animals. Water management has encouraged the spread of these invasive species by creating conditions under which they out-compete the native species formed populations and communities under pre-drainage conditions. Eliminating the invasive and exotic species and the conditions that favor their growth and colonization will contribute to restoration of native plants and animal species and a more natural ecosystem hydrology and function.

#### 4.2.3.3 Species Abundance and Diversity

The changes that have taken place in the natural system have led to decreases in native animal and plant populations. One of the most obvious indicators of this decline is seen in wading bird populations. Several species are now so reduced in numbers that their long-term existence is jeopardized unless measures are taken to ensure their sustainability. Species that have a naturally restricted range could be vulnerable to extinction if their specialized habitats continue to be degraded.

Increasing the spatial extent of natural areas and improving habitat quality directly contributes to increases in species abundance and diversity. Physical and hydrological barriers such as dikes, canal, and levees have severely compartmentalized and fragmented the proposed study area. Fragmented communities are more likely to lose species because the number of individuals in each fragment may be too small to persist. The smaller the fragment, the higher is the likelihood of losing species or favoring an imbalance in the species that do inhabit the areas. Moreover, fragmentation itself alters the landscape by breaking connections between the various habitat types that were distributed historically across the landscape. By eliminating the physical and hydrological barriers and improving the connectivity of habitats in the study area, the range of many animals and their prey-base will be increased and a more natural balance of species will be established.

#### 4.2.4 Project-Specific Ecological Opportunities

The purpose of the C-111 Spreader Canal Western project as originally proposed in the Yellow Book is to “improve deliveries and enhance the connectivity and sheetflow in the Model Lands and Southern Glades areas, reduce wet season flows in the C-111 Canal and decrease potential flood risk in the Miami-Dade County area. As a result of project implementation, there are opportunities to improve the quantity, timing and distribution of water delivered to Florida Bay via Taylor Slough. Hydroperiods and hydropatterns within ENP would be restored to more natural conditions. The restoration of these areas would greatly increase foraging and nesting areas for migratory and wading birds, establish larger corridors for macrofauna in the area and also increase plant and animal species abundance and diversity. There are also opportunities to increase the functional quality of the Model Lands and Southern Glades, leading to increased levels of productivity and greater ecological health. In summary, there are opportunities to:

- Discourage the colonization of invasive exotic species by restoring hydroperiods to more natural conditions
- Reduce water diversions by eliminating or retarding existing drainage features
- Increase the foraging habitat of native species by reducing seasonal dry-outs
- Provide a more even distribution of freshwater flows into the estuaries
- Increase the spatial extent of freshwater wetlands

#### 4.2.5 Water Quality

According to the FDEP 1998 303(d) list, approximately 42 water body segments (both fresh and marine) within the Lower East Coast are use-impaired. Pollutant and water quality constituents causing impairment in these areas include low levels of dissolved oxygen (DO), high levels of mercury and other trace metals, high levels of fecal coliform bacteria, total suspended solids and un-ionized ammonia. Management of stormwater runoff and flooding via existing canal systems has been implicated as a source of water quality degradation in the region. Water quality conditions in receiving water bodies in 2050 are expected to be further degraded, due to the developed condition of the watershed and the continue accumulation of pollutants in sediments in receiving water bodies such as Florida Bay.

Stormwater treatment areas could be constructed in the project area and utilized to intercept polluted discharges from areas of water quality concerns.

Additionally, although water-quality is not a primary purpose of detention areas, the construction and utilization of these facilities would partially filter and

remove pollutant loads from canals discharging into receiving waters in the region. Additionally, by re-distributing water flows and reducing canal discharges into receiving waters, water quality conditions in the area could be improved to better meet standards for the area.

#### 4.2.6 Economic and Social Well-Being

The C&SF project, by providing flood protection and water supply, has enabled the population of south Florida to grow from approximately 900,000 persons in 1950 to over 5.5 million in 1995. By 2050, population is projected to grow to 11.6 million. Increases in population growth intensify the competition for and stress upon regional water resources.

In the south Florida region in general and the Lower East Coast in particular, per capita income levels are higher than in the rest of the state. There is a strong per capita income difference between the urbanized Lower East Coast and the agricultural areas surrounding Lake Okeechobee. Employment and income opportunities in the important industries of agriculture and tourism are heavily reliant on the benefits provided by the C&SF project.

Agriculture and tourism were identified as “critical industries” by the Governor’s Commission for a Sustainable South Florida. Agriculture depends upon the system for vital water supply and flood protection. The tourism industry is dependent upon the project in a myriad of ways. For example, a healthy ecosystem and its attendant tourism are the mainstays of the Monroe County economy, as reflected by the relative domination of economic activity there in the services, retail trade, and fisheries industries. The ability to sustain the region’s economy and quality of life depend, to a great extent, on the success of the efforts to protect and better manage the region’s water resources. A stable and healthy area ecology will directly benefit the local economy through increases in tourism and dollars generated by the resident who enjoy outdoor activities.

### 4.3 OBJECTIVES AND CONSTRAINTS

#### 4.3.1 Project Objectives

Project objectives were based initially on the original objectives for the entire C-111 SC project described in the Comprehensive Plan. Concerning the timing and duration of the objectives, all are expected to be met within the Period of Analysis for the proposed project and the effects are anticipated to be permanent. The original project objectives that were developed by the PDT are as follows:

1. Improve flow patterns, hydroperiods, and ecological connectivity of the Southern Glades, Model Lands and adjacent natural areas
2. Improve habitat, functional quality of existing natural areas and increase spatial extent where practicable
3. Improve native plant and animal species abundance and diversity
4. Reserve sufficient water for the restoration of the natural system
5. Eliminate ecologically damaging flows through C-111 Basin to Barnes Sound and Florida Bay
6. Provide ecologically compatible water quality consistent with restoration goals and federal and state requirements applicable to the Southern Glades, Model Lands and ENP

#### 4.3.2 Revised Project Objectives Specific to the C-111 Spreader Canal Western Project

Due to stakeholder concerns and a number of decision critical uncertainties associated with the entire C-111 SC project, the proposed project was split into two separate projects, the C-111 SC Western project and the C-111 SC Eastern project. An extremely thorough discussion of the planning process that documents the splitting of the original project is included in *SECTION 5* of this PIR. The C-111 SC Western project was selected to go forward at the outset, as the restoration features would be fairly low risk and provide learning opportunities for further restoration via the C-111 SC Eastern project. The revised project objectives for the C-111 SC Western project are listed as follows:

- Restore the quantity, timing, and distribution of water delivered to Florida Bay via Taylor Slough to levels nearest as possible to the pre-drainage model runs;
- Improve hydroperiods and hydropatterns in the Southern Glades and Model Lands. The hydroperiods will be improved to optimal levels to support historical vegetation patterns nearest as possible to the pre-drainage model runs; Hydropatterns will be restored to historical sloughs and associated tributaries.
- Return coastal zone salinities in western Florida Bay to levels as close as possible to pre-drainage scenario model runs by restoring upstream water levels in eastern Everglades National Park.

#### 4.3.3 Project Constraints

Project constraints were developed to ensure that the proposed project would not reduce levels of service for flood protection nor adversely affect endangered species. Additionally, legal and policy restraints were taken into consideration in the development of the objectives and constraints for the proposed project. The project constraints are listed as follows:

1. Maintain existing (December 2000) levels of flood protection in the project area;
2. Avoid impacts to the federally-listed endangered species Cape Sable seaside sparrow.
3. Maintain operational flexibility for distribution of limited water resources and implementation of the Eastern PIR in accordance with IAR principles.

**SECTION 5  
FORMULATION AND EVALUATION OF ALTERNATIVES**

**5.0 FORMULATION AND EVALUATION OF ALTERNATIVE PLANS****5.1 PROJECT EVALUATION CRITERIA, PERFORMANCE MEASURES, AND EVALUATION METHODS AND MODELS**

The plan formulation process for the C-111 SC Western project utilized the Yellow Book plan as a starting point for the development of alternatives. After a NEPA scoping meeting, a Project Delivery Team (PDT) of various local, state, and federal agency personnel was assembled. The PDT defined the ecological problems and restoration opportunities in the project area, inventoried the existing conditions, and then forecasted the anticipated future conditions that would develop without any Federal action in the project area. Performance measures and restoration objectives were then developed in order to measure the capability of each alternative. The PDT then formulated a series of alternative plans, conducted hydrologic modeling on each plan, and then calculated Habitat Units with the performance measures that had been developed. The alternative plans were then evaluated and compared. During this process, the PDT identified the merits of each alternative and then determined how well each alternative met the planning objectives, performance measures, and other evaluation criteria for the proposed project. After plan comparison, the PDT then selected an economically-viable Recommended Plan that would provide for environmental restoration in the project area. The following information in this section provides a more detailed account of how the Recommended Plan was selected for the proposed C-111 Spreader Canal Western project.

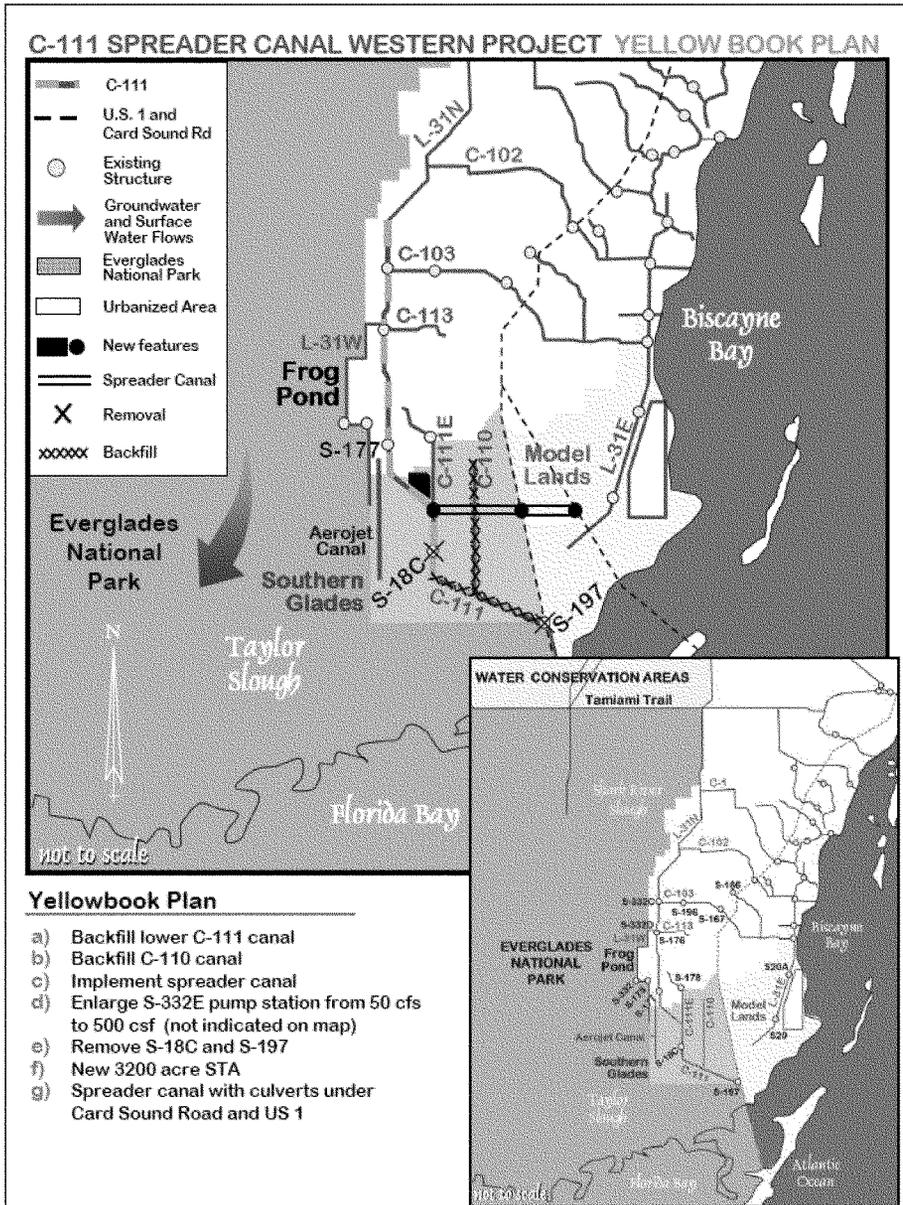


FIGURE 5-1: YELLOWBOOK PLAN

## 5.2 PRIOR FORMULATION FROM THE YELLOW BOOK

The project plan in the Yellow Book (*FIGURE 5-1*) was identified as the C-111N Spreader Canal. The Yellow Book plan included a spreader canal, the construction, modification or removal of levees, canals, pumps, water control structures, culverts, and a stormwater treatment area (STA). Specifically, the plan included:

- The construction of a 3,200-acre STA;
- The construction of a 6.5 mile long Spreader Canal running from west to east from the C-111E Canal supplied via a 500 cubic-feet-per-second (cfs) pump;
- The enlarging of pump station S-332E from 50 cubic-feet-per-second (cfs) to 500 cfs;
- Increasing the capacity of C-111N for the higher capacity of flow and the extension of the canal approximately two miles under U.S. Highway 1 and Card Sound Road into the Model Lands; and,
- Culverts under U.S. Highway 1 and Card Sound Road.

Water would be pumped from the C-111 and C-111E canals through two 250 cfs pump stations into a STA prior to discharging through S-332E to the Southern Glades and the Model Lands through the C-111N Canal. Additional features in the plan would include:

- Filling the southern reach of the C-111 Canal below C-111N to S-197;
- Removal of structures S-18C and S-197;
- Complete backfilling of C-110; and,
- The removal of adjacent levees and roads.

The total initial cost of the Yellow Book plan was estimated to be \$94,034,000, with costs broken down as follows:

- |                          |              |
|--------------------------|--------------|
| • Planning               | \$1,990,000  |
| • Engineering and Design | \$1,326,000  |
| • Real Estate            | \$45,766,000 |
| • Construction           | \$44,952,000 |

The annual operational costs were estimated at \$60,000.

## 5.3 PLAN FORMULATION RATIONALE

### 5.3.1 Management Measures

Management measures that would serve as the basis for alternative composition were formulated by the PDT. Basic construction features such as canals, levees,

backfill, and plugs were coalesced to form six management measures. The six management measures were then used as stand-alone alternatives or combined to create alternatives in different configurations and settings across the proposed project area. The management measures formulated for the initial array of alternatives are listed as follows:

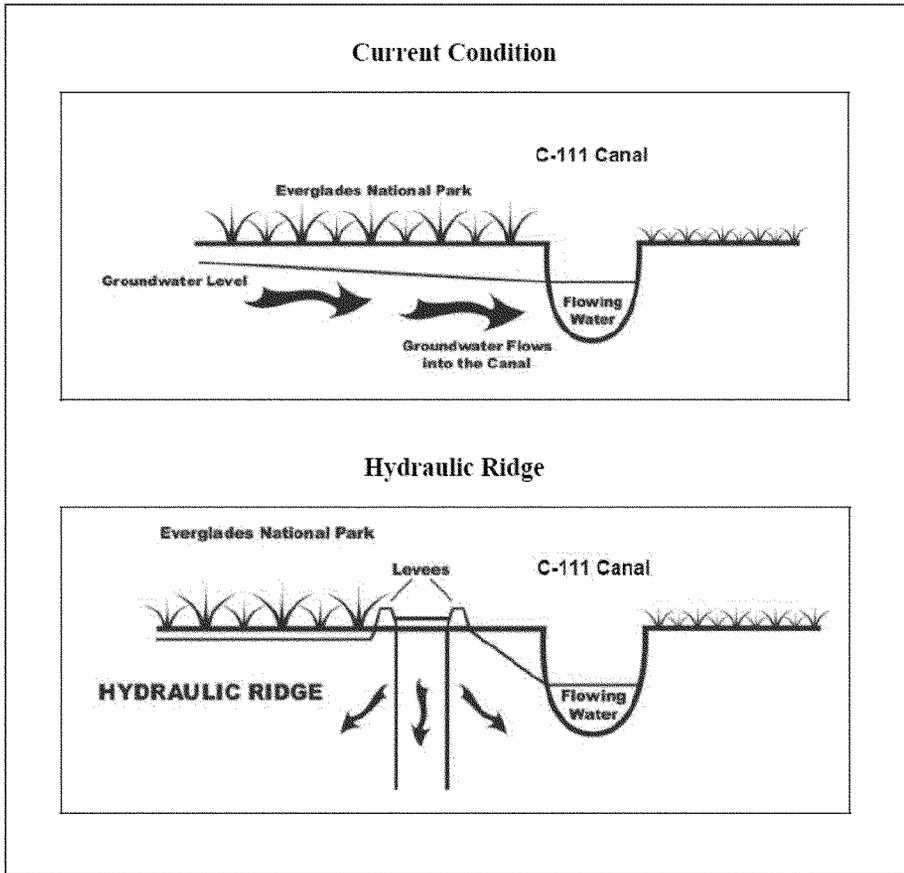
- **Water Quality Treatment**—This measure is further subdivided into three separate measures: STAs, restoration of existing sloughs to filter water, and best management practices (BMP). STAs would be constructed in areas that would receive high volumes of canal flow. Water would be retained for lengths of time sufficient to eliminate toxins and pollutants. Water would then be released back into canals for water diversion and distribution. Most STAs would require the construction of a seepage management canal to prevent undesirable flooding that may occur.
- **Water Detention Areas**—Water detention areas are the foundation of a number of alternatives and would be constructed in order to retain water and create a hydraulic ridge. A hydraulic ridge is established by creating an area with controlled groundwater infiltration between a drainage feature and an area that is being drained. The increased groundwater raises the water table higher than the area that is being drained. The down slope gradient towards the drainage feature is then reversed, allowing water in the area that was being drained to flow along the natural, existing contours. The two diagrams in *FIGURE 5-2* show an area before and after a hydraulic ridge is created by a water detention area. Two designs for water detention areas were contemplated. One would consist of an above-ground impoundment that is surrounded by levees in order to hold water. Water would be pumped into the area and allowed to naturally infiltrate into the ground. The second detention area design would utilize an existing canal in order to limit any impacts to natural areas. Levees would be constructed around the exterior limits of the canal, and water would then be pumped into the area to create a higher water stage than would normally be found in the canal. All exiting flow way features in the canal would be blocked. There would be no difference in the capabilities of the two designs to create a hydraulic ridge.
- **Elimination or retarding of drainage and flow barriers**—Only prevalent features such as the elimination of the lower C-111 Canal and filling of the Aerojet Canal were actually termed management measures. Both complete backfilling and the plugging of drainage canals were included as management measures. For the construction of a plug, earthen material is deposited into a canal at a pre-determined width and height to adequately block the flow of water. A plug, which typically costs

approximately \$55,000, can be as effective as a complete backfill at less cost if the hydrogeology of the area is conducive.

- Land Conservation—Land conservation, although not active restoration, would ensure that areas were not developed and would serve as a buffer to existing natural areas.
- Operations—Changes in operations or triggers in pump stations or structures respectively would be part of every alternative. An operational alternative, comprised totally of this measure, was formulated to meet programmatic requirements.
- Spreader Canal System—Spreader canal systems were included in most of the alternatives in the initial array. Most spreader canal systems consisted of a pump station along an existing, major conveyance canal. The pump stations would discharge water into newly-constructed spreader canals, dispersing flows across large swaths of wetlands for rehydration.

After a review of the management measures, the team determined that all were feasible and would be included in some magnitude within the initial array of alternative plans.

Note: Minor activities such as ditch plugging and the elimination of exotic species are expected to be performed in routine maintenance of any measure or subsequent alternative that is implemented. As these activities are not major components and would not affect any cost comparison, they have not been included as management measures.



**FIGURE 5-2: HYDRAULIC RIDGE: BEFORE AND AFTER ESTABLISHMENT**

### 5.3.2 Formulation of Alternative Plans

The plan formulation and evaluation process for the C-111 SC project involved identifying, organizing, and combining management measures to create different alternative plans. The alternative plans were developed at a conceptual level while best considering the goals, objectives and constraints of the project. A total of 22 conceptual alternatives were formulated. The alternatives, including the original Yellow Book plan, are listed and described in *APPENDIX F*.

Alternatives that would not be feasible or were minor variations of other alternatives were subsequently screened from consideration after evaluation by the PDT. The remaining alternatives were then modeled, refined, and in some

cases re-modeled. The resulting analysis of the model runs indicated there may be issues in meeting project objectives with all of the alternatives, particularly objectives associated with Florida Bay.

### 5.3.3 Agency Concerns and Limitations on Restoration

In mid-2006, the Department of the Interior (DOI) began to raise concerns related to the construction of the original C-111 SC project (1994 GRR) which, according to the DOI, were unlikely to be addressed through implementation of the recommendations contained in the 1994 GRR. The DOI's specific concern was the project features recommended in the 1994 GRR would not increase flows within Taylor Slough to the degree necessary to reduce hypersalinities in eastern Florida Bay.

In its September 2006 draft position paper, the DOI articulated its position that the C-111 SC project represented an opportunity to address its concerns. Additionally, in a letter dated September 13, 2006, the Everglades Foundation, a non-governmental organization (NGO), noted its opinion that more consideration should be given to Taylor Slough. It also noted that all of the initial restoration plans would distribute high volumes of water to the east, while the flow distribution to Florida Bay would hardly change. As such, the Everglades Foundation recommended that one of the primary objectives of the proposed project should be to improve freshwater flows into Florida Bay for environmental benefit.

As a result of the DOI and the Everglades Foundation concerns, USACE and SFWMD project team consulted the Quality Review Board (QRB). The QRB is a coordination and issue resolution team comprised of USACE, SFWMD and DOI senior leadership. As such, the QRB advised the USACE and the SFWMD staff to consider the inclusion of project features which have the potential to increase flows to Florida Bay via Taylor Slough.

In addition to the stakeholder's concerns regarding the sufficiency of flows to Florida Bay via Taylor Slough, it became evident that other decision critical uncertainties surrounded the proposed project. The uncertainties were generally related to the future availability of water for restoration purposes, S-178 water quality, and potential backwater effects related to the proposed spreader canal alignment and size as well as proposed elimination of the lower C-111 Canal (south of structure S-18C).

### 5.3.4 Incremental Adaptive Restoration and the Splitting of the Project Implementation Report

In its first Biennial Review of the Progress Toward Restoring the Everglades (November 2006), the National Research Council (NRC) Committee for

Independent Scientific Review of Everglades Restoration Progress (CISRERP) concluded that if the construction of restoration projects is delayed until the many scientific uncertainties are eliminated, there will be many negative consequences, including continued decline of the Everglades ecosystem, lagging public support, and increased project costs. The NRC recommended an approach referred to as Incremental Adaptive Restoration. The IAR approach is based on recognition that the implementation of increments of CERP projects will provide some immediate restoration benefits while addressing scientific uncertainties, in turn promoting learning that can guide the remainder of the project implementation through adaptive management (AM). Remaining phases can then be designed to optimize performance based on actual findings from the earlier phases.

As a result of the project uncertainties and stakeholder concern that the yet to be completed C-111 South Dade Federal project would not do enough to restore flows to Eastern Florida Bay via Taylor Slough, federal and local-sponsor leadership recommended that the PDT develop a two-PIR approach that would incorporate the principles of the National Research Council's approach to IAR. Pursuant to the request, a revised plan formulation approach was developed by the PDT. The approach was presented to USACE HQ/SAD in a strategy paper and approved during an In-Progress Review (IPR) in July 2007. The approach was presented to the QRB in July 2007, and was well-received.

### 5.3.5 Dual Project Implementation Report Approach

Pursuant to the revised plan formulation approach, the proposed project was split into two separate, yet related projects. The first project is the C-111 SC Western project and will primarily concentrate on improving freshwater flows to Florida Bay via Taylor Slough. The second project will be the C-111 SC Eastern project and will mainly concentrate on environmental restoration in the Southern Glades and Model Lands. The planning and design of the Eastern PIR will be dependent upon observed data gained from the implementation of Western PIR.

The following sections detail the revision of project formulation for the C-111 SC Western PIR. The previously-formulated management measures for the overall project were evaluated and determined to be sufficient for the C-111 SC Western PIR. As such, a revised Initial Array of Alternatives was formulated for the C-111 SC Western PIR.

### 5.3.6 Revision of the Initial Array of Alternatives

A new set of specific objectives for the C-111 SC Western PIR was formulated to address changes to the project scope due to the dual PIR approach. Although the main goal of the C-111 SC Western project is the improvement of water flows to

Florida Bay via Taylor Slough, restoration goals in the Southern Glades and Model Lands were also addressed. The C-111 SC Western project objectives are as follows:

- Restore the quantity, timing, and distribution of water delivered to Florida Bay via Taylor Slough to levels nearest as possible to the pre-drainage model runs;
- Improve hydroperiods and hydropatterns in the Southern Glades and Model Lands. The hydroperiods will be improved to optimal levels to support historical vegetation patterns nearest as possible to the pre-drainage model runs; hydropatterns will be restored to historical sloughs and associated tributaries.
- Return coastal zone salinities in western Florida Bay to levels as close as possible to pre-drainage scenario model runs by restoring upstream water levels in eastern Everglades National Park.

Using the above-listed objectives and previously formulated management measures, the PDT utilized information gained from previous modeling exercises to develop a new array of alternatives (*TABLE 5-1* and *APPENDIX F*). Each of the new alternatives is focused on meeting the new planning objectives of the C-111 SC Western project.

TABLE 5-1: REVISED INITIAL ARRAY OF ALTERNATIVES

No-Action	Future Without Project Condition
Alternative 1C	Includes FPDA approximately 530 acres with maximum depth of 3 feet, pump for FPDA intercepts available water.
Alternative 2C	Includes FPDA approximately 530 acres with maximum depth of 3 feet, pump for FPDA intercepts available water, pump upstream of S-177 to discharge into Aerojet Canal
Alternative 3C	Includes FPDA approximately 530 acres with maximum depth of 3 feet, pump for FPDA intercepts available water, pump upstream of S-177 to discharge into Aerojet Reservoir
Alternative 4C	Increase pumping at S-332D; maximum of 1,000 cfs
Alternative 5C	Includes one new pump at southern C-111 Canal.
Alternative 6C	Construct seepage barrier from northern portion of L-31W (just west of S-332D) south along FPDA to the southern end of Aerojet Canal.
Alternative 1D	Same as Alternative 1C, plus: one new operable structure in the lower C-111, incremental operational changes at S-18C, one plug at S-20A, operational changes at S-20, and 10 plugs located in the C-110 Canal.
Alternative 2D	Same as Alternative 2C, plus: one new operable structure in the lower C-111, incremental operational changes at S-18C, one plug at S-20A, operational changes at S-20, and 10 plugs located in the C-110 Canal.
Alternative 3D	Same as Alternative 3C, plus: one new operable structure in the lower C-111, incremental operational changes at S-18C, one plug at S-20A, operational changes at S-20, and 10 plugs located in the C-110 Canal.
Alternative 4D	Same as Alternative 4C, plus: one new operable structure in the lower C-111, incremental operational changes at S-18C, one plug at S-20A, operational changes at S-20, and 10 plugs located in the C-110 Canal.
Alternative 5D	Same as Alternative 5C, plus: one new operable structure in the lower C-111, incremental operational changes at S-18C, one plug at S-20A, operational changes at S-20, and 10 plugs located in the C-110 Canal.
Alternative 6D	Same as Alternative 6C, plus: one new operable structure in the lower C-111, incremental operational changes at S-18C, one plug at S-20A, operational changes at S-20, and 10 plugs located in the C-110 Canal.

**Alternative 1C:** This alternative would include an approximately 530-acre detention area at the Frog Pond. Water would be withdrawn from the C-111 Canal and pumped into the facility, maintaining water at approximately 3-foot NGVD. The flooded detention area would then function as a hydraulic ridge, preventing water from seeping out of Taylor Slough into the C-111 Canal.

Note: A sizing analysis for the FPDA is located in the Plan Formulation Appendix.

**Alternative 2C:** Alternative 2C would include the above-mentioned Frog Pond Detention Area as well as the Aerojet Canal feature. The Aerojet Canal is an existing drainage feature that would be utilized to extend the hydraulic ridge of the proposed Frog Pond Detention Area to the south. A pump station and feeder canal would be constructed to withdraw water from the C-111 Canal and discharge into the Aerojet Canal.

**Alternative 3C:** This alternative is identical to Alternative 2C except that a reservoir would be constructed in the Aerojet Canal area. The Aerojet Reservoir would be a comparable size to the Frog Pond Detention Area and would serve to extend the hydraulic ridge further south.

**Alternative 4C:** Alternative 4C would include increasing the pumping capacity at S-332D to a maximum of 1,000 cfs. The S-332D structure currently discharges water into an existing drainage feature that feeds Taylor Slough. Alternative 4 would therefore substantially increase the amount of water that is discharging into Taylor Slough.

**Alternative 5C:** This alternative would consist of installing a new pump at the southern C-111 Canal. The pump station would distribute water across the area adjacent to the C-111 Canal to rehydrate the area and create a hydraulic ridge.

**Alternative 6C:** This alternative would consist of the construction of an in-ground, permanent seepage barrier from just west of S-332D to the end of the Aerojet Canal. The barrier would serve to block groundwater from seeping out of Taylor Slough into the C-111 Canal.

**“D” Series Alternatives (1D, 2D, 3D, 4D, 5D, and 6D):** Each of the “D” series alternatives was identical to the “C” series alternatives except for three additional features. The three additional features of the “D” series were intended to increase restoration in the Southern Glades and Model Land with minimal uncertainty and cost. These features would also provide information to address uncertainties for the Eastern PIR such as the elimination of the lower C-111 Canal. The features consisted of one new operable structure in the lower C-111 Canal, incremental operational changes at S-18C, one plug at S-20A, operational changes at S-20, and ten plugs in the C-110 Canal. The new operable structure in the lower C-111 Canal will serve to impede water flow in the canal thereby raising water levels in the canal upstream. This in turn will raise groundwater levels in the surrounding wetland areas. Although two plugs were previously proposed in this area, the incremental operational changes will supplement the one plug that is proposed. The changes will further increase upstream canal stages, essentially serving the same purpose as an additional plug while providing a cost savings to the project.

The plug at S-20A and the operational changes at S-20 will perform the same functions as the operable structure in the lower C-111 Canal and the incremental operational changes at S-18C; however, the restoration effects of these features would provide restoration in the Model Land towards the eastern boundary of the proposed project.

Rather than completely backfilling the C-110 Canal at this time, a series of plugs have been proposed that would serve the same purpose. The plugs would serve to raise water levels in the canal to that of the surrounding wetlands, thereby eliminating the negative gradient established by the drainage canal. As such, by eliminating the drainage effects of the canal, flow in the area should be restored to natural hydro patterns and sheetflow. The plugs in the canal would be constructed of existing spoil that was side cast during initial excavation of the canal. Utilizing the onsite material was seen as a cost-saving measure as trucking immense loads of fill material into the project site for a complete backfill would be expensive and could limit the amount of restoration possible in the Western project. The rationale for the number of plugs necessary to impede the effects of the canal is directly related to the overall length of the canal. The plugs must be positioned in close enough proximity to one another or erosion will occur due to increased velocity of canal flow.



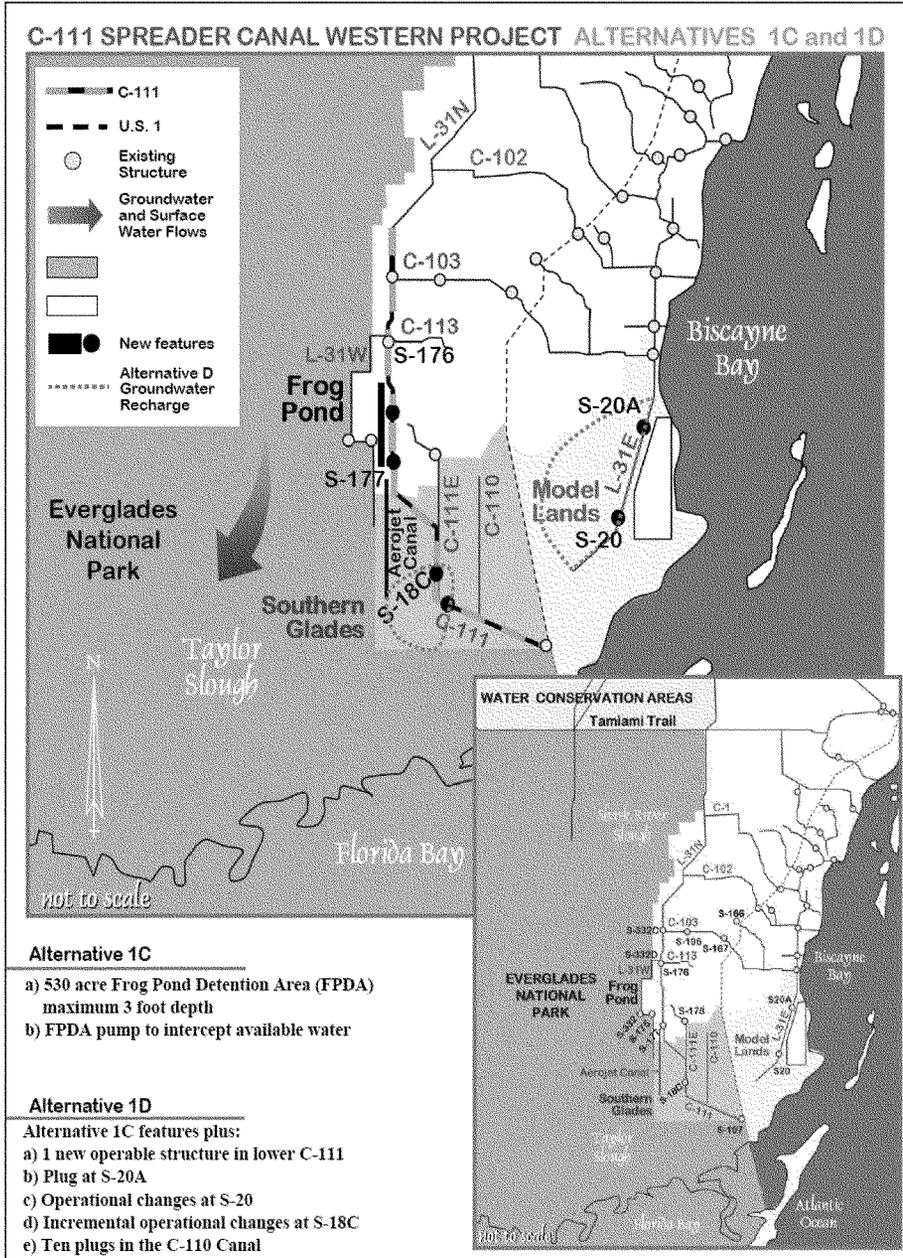


FIGURE 5-4: ALTERNATIVES 1C AND 1D

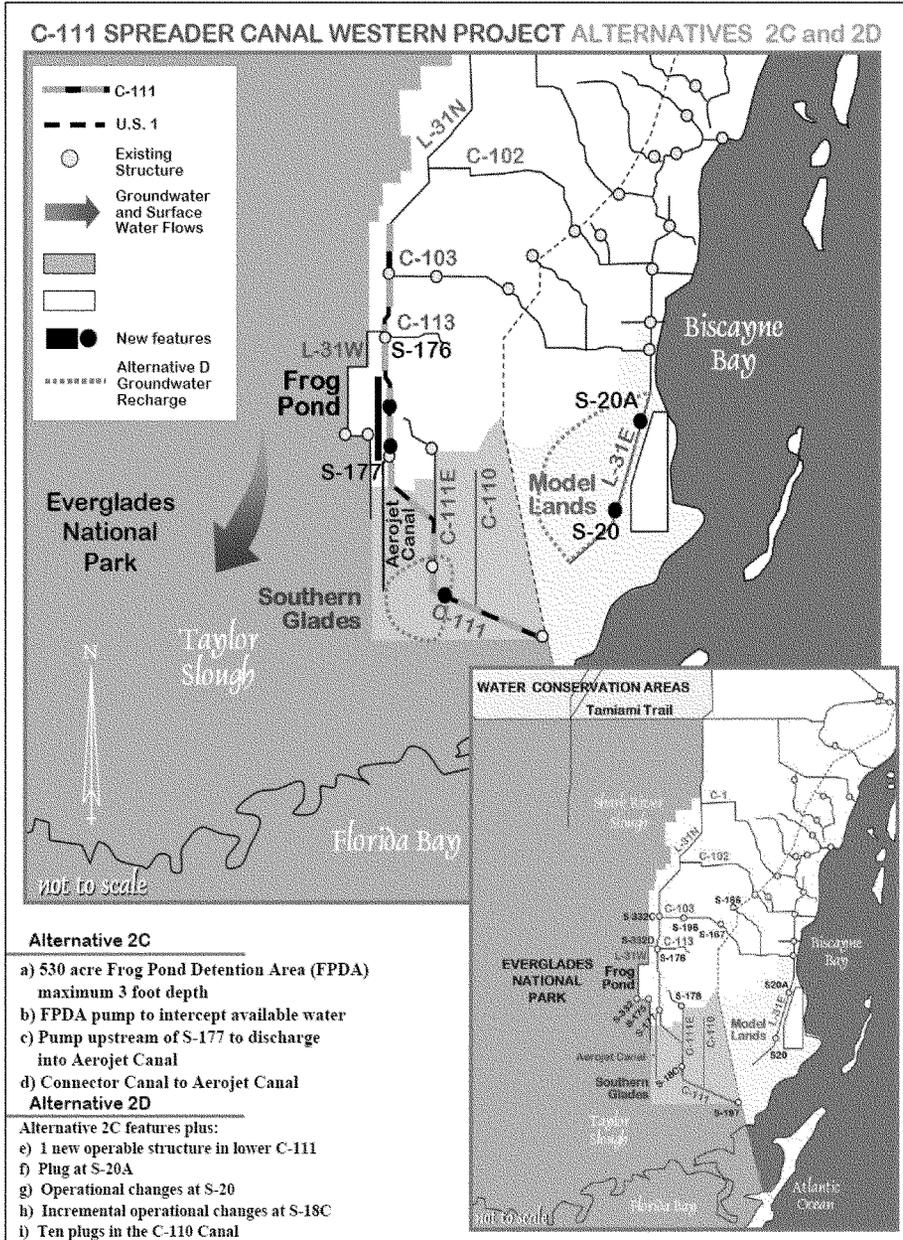


FIGURE 5-5: ALTERNATIVES 2C AND 2D

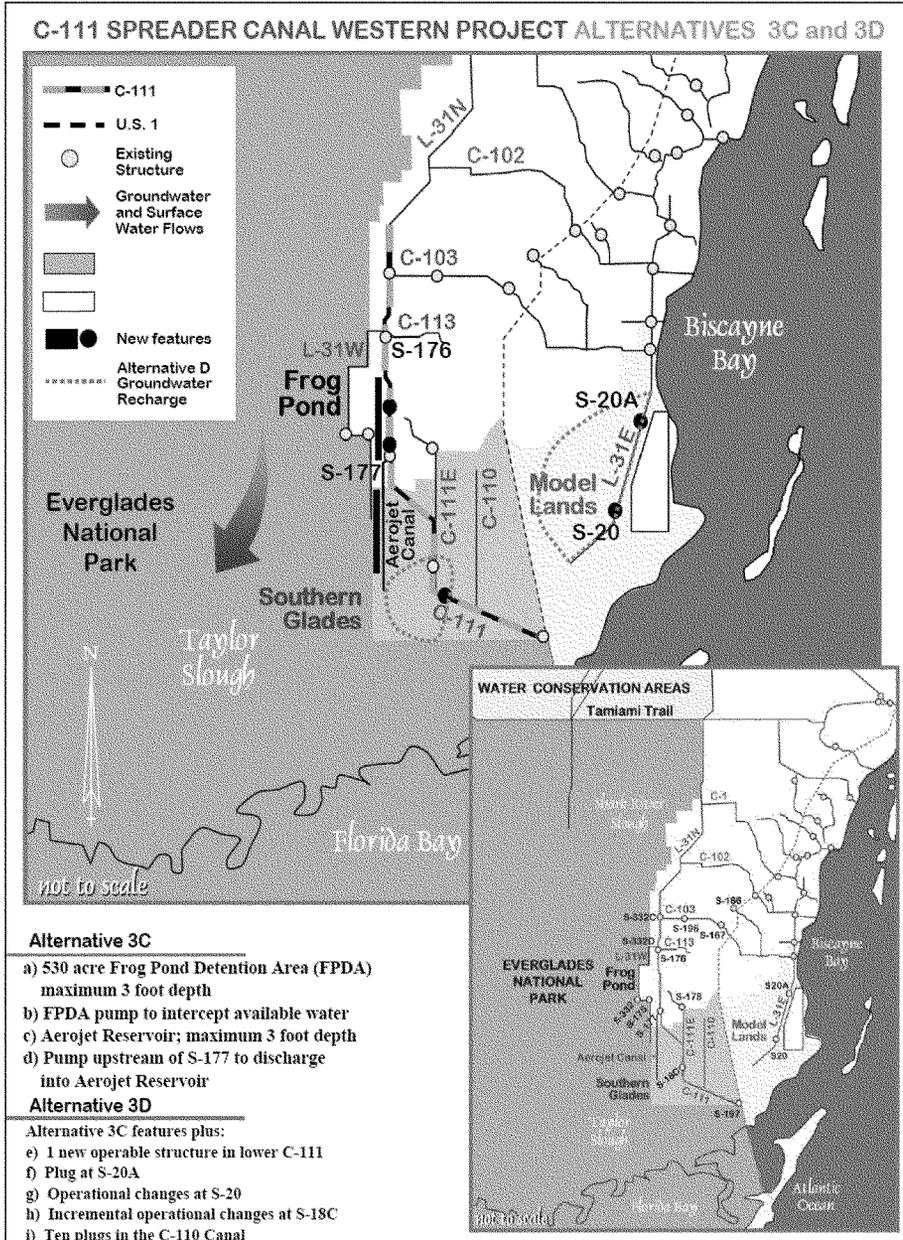


FIGURE 5-6: ALTERNATIVES 3C AND 3D

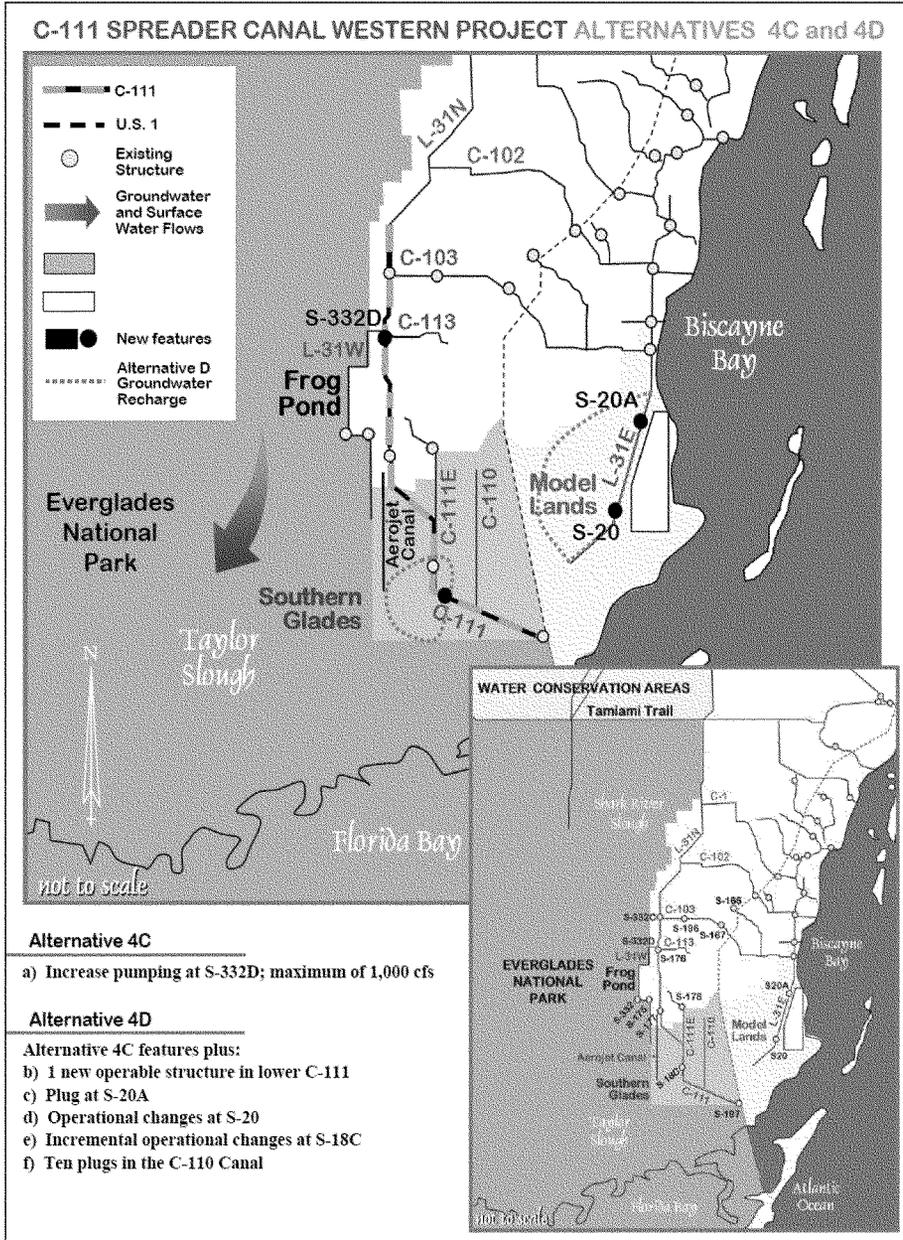


FIGURE 5-7: ALTERNATIVES 4C AND 4D

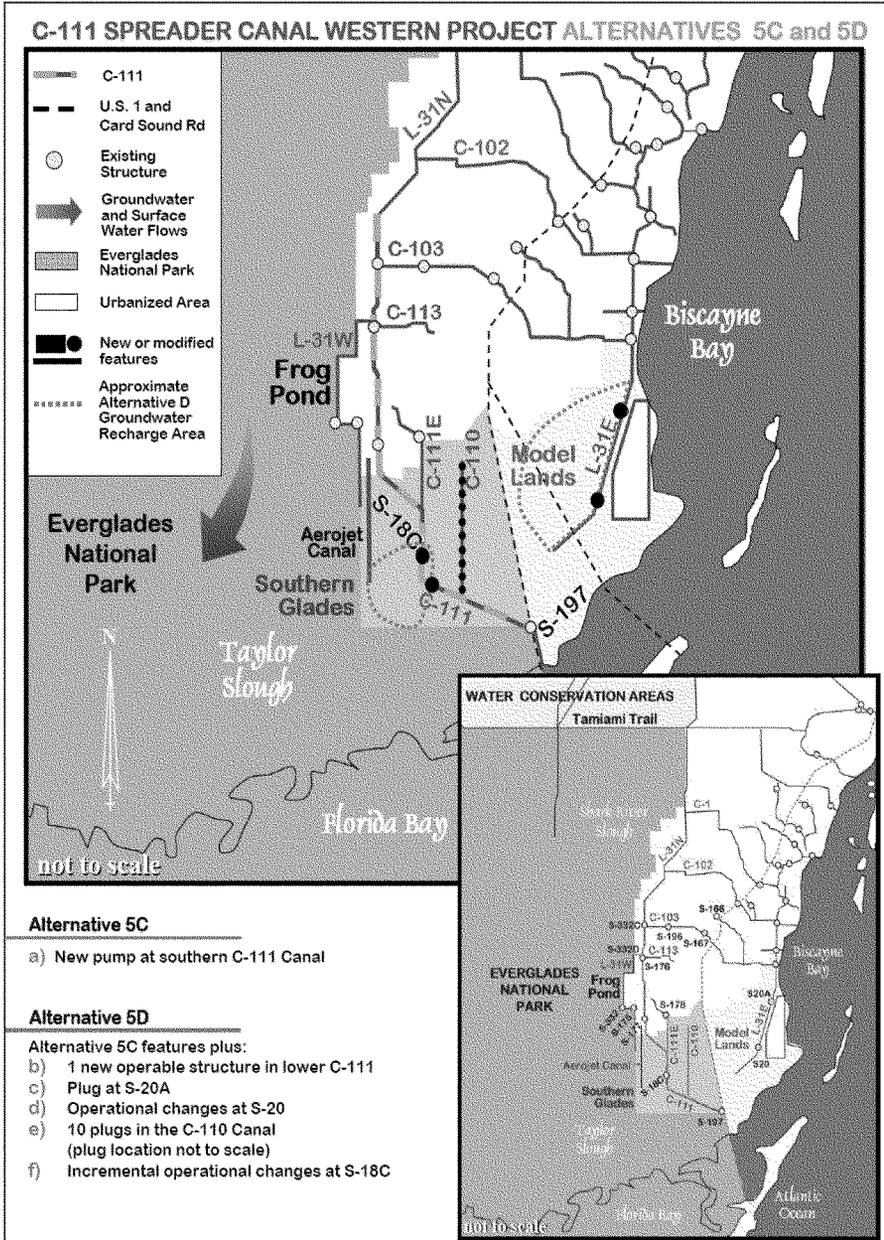


FIGURE 5-8: ALTERNATIVES 5C AND 5D

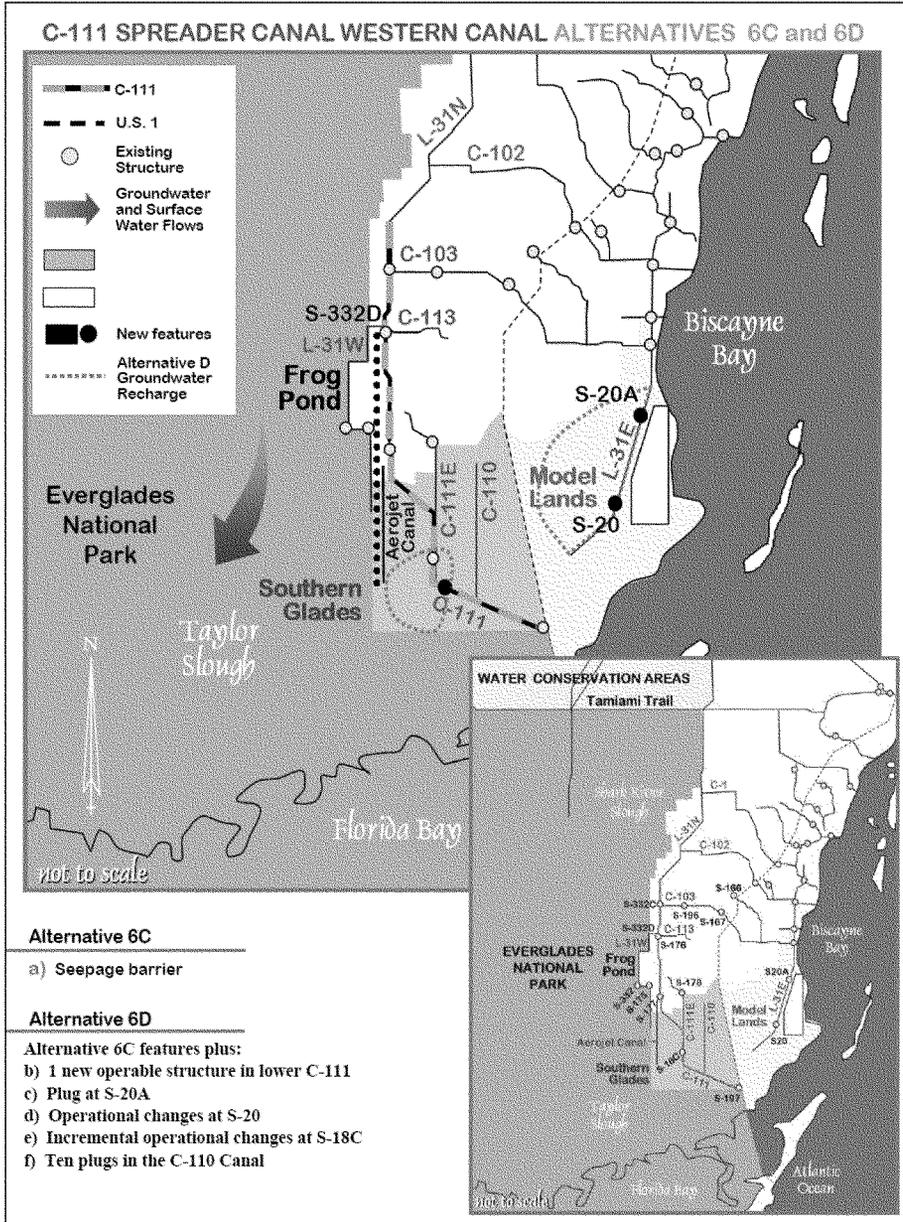


FIGURE 5-9: ALTERNATIVES 6C AND 6D

#### 5.3.6.1 Screening of the “C” Series Alternatives and Alternative 4D and 5D

Analysis of the modeling for the Revised Initial Array of Alternatives reaffirmed that the “D” series alternatives would provide greater overall ecosystem benefits and more complete restoration than the “C” series alternatives. As such, the incremental benefits of each “D” series alternative, relative to the corresponding “C” series alternative, were expected to greatly exceed the added costs. Both Alternative 1C and Alternative 1D led to negative project effects, but Alternative 1D provided over 1,500 more habitat units than 1C with a low cost per habitat unit. It is apparent when examining Alternative 1 with the absence of the secondary “D” series features the negative impacts are much greater than Alternative 1 which includes the “D” series features. As a result, it was decided to screen all “C” alternatives from further consideration; however, Alternative 1C was retained for cost bracketing purposes as it appeared to represent the “least cost alternative.”

Alternative 4D, which involved increasing pumping at S-332D to a maximum of 1,000 cfs, was also eliminated due to this alternative being unimplementable. Previously established C&SF operational criteria restricts pumping at S-332D to only 165 cfs for certain durations of the year. The pumping restrictions are due to conservation of the Federally-listed Cape Sable seaside sparrow.

Alternative 5D included replacing S-177 with a similarly-rated pump to be located at the southern C-111 Canal. The pump station would distribute water across the area adjacent to the C-111 Canal to rehydrate the area and create a hydraulic ridge.

Alternative 5D was screened from further consideration as it would not meet the primary project objective of restoring the quantity, timing, and distribution of water delivered to Florida Bay via Taylor Slough. The hydraulic ridge that would be created by the proposed project would occur too far to the south and east to effectively block seepage towards the C-111 Canal.

#### 5.3.6.2 Optimization of Alternative 2D

During the screening of the Revised Initial Array of Alternatives, it became apparent that the Aerojet Canal feature in Alternative 2D may require more water than is currently available for optimal function. As such, an additional alternative, 2DS, was developed. In the plan for Alternative 2DS, the Aerojet Canal feature was shortened to approximately half of the original length. The rationale for the size reduction was that with less water available, this feature would take advantage of the existing amount of water for the formation of a hydraulic ridge. For clarification, the prior Alternative 2D, with the full length Aerojet feature, was renamed Alternative 2DL.



### 5.3.7 Presentation and Evaluation of Final Array of Alternative Plans

For the evaluation of the final array of alternatives, more specific operational criteria were developed in order to refine the analysis. The criteria were utilized in the ModBranch model to more closely simulate actual conditions that would exist for the implementation of each alternative. In addition to the ModBranch hydrologic modeling using the new criteria, more refined costs were developed for each alternative in the Final Array, including the cost for any real estate takings that may occur due to flooding impacts. The Final Array of Alternatives is listed below:

- No-Action (FWOP condition)
- Alternative 1C
- Alternative 1D
- Alternative 2DS
- Alternative 2DL
- Alternative 3D
- Alternative 6D

The MODBRANCH model was used as part of the C-111 Spreader Canal (C-111 SC) PIR1 study to estimate the flooding impacts of the alternatives. For the six final alternatives, designated as Alternatives 1C, 1D, 2D Short, 2D Long, 3D, and 6D, each alternative was modeled and compared to the Existing Condition Base (ECB). The MODBRANCH model and the final alternatives are described in more detail in **APPENDIX A, ENGINEERING, SECTION A.10**. MODBRANCH is a hybrid code that couples MODFLOW, a three-dimensional groundwater flow model with Branch, a one-dimensional canal routing model. **FIGURE A-20**, in **APPENDIX A** shows the model domain (blue line) superimposed on an aerial photograph of the area. Major canals are shown in red. This figure illustrates the complexity of the area. Land elevations vary from the high Atlantic Ridge to the low Everglades. Land use varies from urban to suburban to agricultural to wilderness. Both, ground water and overland flow are simulated by the MODFLOW part of MODBRANCH. MODFLOW is a pseudo-three-dimensional, finite difference, ground water model (McDonald and Harbaugh, 1988). This model requires defining a model “grid” of specified numbers of rows, columns, and layers. The width of each row or column is determined by required resolution in specific areas. The model grid is shown in **FIGURE A-21**, in **APPENDIX A** with major canals superimposed. The model is bounded by the Biscayne Bay to the east; Florida Bay to the south; and, the Gulf of Mexico to the west. The northern boundary is roughly 2 miles north and parallel to the following canals: C-6, L-30, L-67C and L-29. The model grid is made up of 239 rows, 259 columns, and 5 layers. The grid resolution varies horizontally from a minimum of 207 feet to a maximum of 5000 feet. Levees are defined by using the horizontal flow barrier package of MODFLOW. The U.S. Army Corps of Engineers, Jacksonville District, made additional model

refinements and extended the model domain which was used in previous studies. The savings clause/takings analyses require using the ECB configuration. Various Performance Measures were developed for the flood impacts. Normal hydroperiods used for ecological impacts are based on the number of days in a year that the stage is above the ground. However, for flood impact analysis, hydroperiods are computed as the number of days within a specified season that the water depth exceeds a specified value. The data are divided into two seasons (wet and dry) and eleven depth values are used (+/-2.0, +/-1.5, +/-1.0, +/-0.5, +/-0.25, 0.0 ft). A second flood impact Performance Measure is the longest single duration water is above a stage that is specified between 0 and 24" below the ground, in increments of 2". This Performance Measure is useful in determination of impacts on various crops. Both types of data were provided for each cell to allow further post-processing using GIS packages.

After modeling was completed, an analysis was started to determine the impacted lands for each of the six final alternatives. The Office of Counsel team member working with the geographic information system specialists determined that a formula could be written and applied to each alternative which would show impacted lands. After the modeling data for each alternative along with the modeling data for the ECB was provided to GIS, they used the data to create extensive spreadsheets, maps, and data information for review by Office of Counsel to determine what lands were impacted by each of the alternatives. The comparisons had to account for changes in hydrology that would be significant enough that land acquisition would be required. The formula ultimately used would have to compare each alternative in a similar fashion and would not compromise the results. The comparison would have to account for both groundwater and surface water impacts to different land classes.

Once this data was provided by GIS, each parcel or percentage of the parcel was reviewed to determine if only a portion (and what portion) or all of the parcel would have to be acquired. This was done for each alternative independently. Once the analysis was complete, the information was provided to Real Estate Division to provide a cost estimate for each of the final alternatives.

The impacted lands for each alternative were initially analyzed and computed based on the compilation of the following three criteria:

Criteria 1: Non-Agricultural Lands (40days+30 percent)

Alternative Annual Hydroperiod (at surface) is greater than 40 days longer than ECB run and this value is greater than 30 percent longer than ECB for any of the three years (Average year, Dry year, Wet year)

Criteria 2: Agricultural Lands for Dry Season (Any increase of Hydroperiod at-.5ft)

Alternative Dry Season Hydroperiod (at -.5ft) is greater than 5 days longer than ECB Dry Season Hydroperiod (at -.5ft) for any of the three years (Average year, Dry year, Wet year)

Criteria 3: Agricultural Lands for Wet Season (30days+20 percent)

Alternative Wet Season Hydroperiod (at -.5ft) is greater than 30 days longer than ECB wet season Hydroperiod (at -.5ft) AND this value is greater than 20 percent longer than ECB for any of the three years (Average year, Dry year, Wet year)

Extensive Spreadsheet Data was then provided by GIS that showed the hydrologic changes for each of the "impacted grid cells", including impacts in each year; impacts in the wet seasons of each year; impacts in the dry season of each year; and the percentage of each individual parcel impacted. For the non-agricultural lands, a more detailed analysis was conducted to determine if the impacts were significant. For instance, if the Existing Condition had no shown hydroperiod but for the alternative there was a 40 day increase in hydroperiod across the entire year which would be a 30 percent increase, the lands impacted by this increase were screened out. This was applied to each alternative. Non-agricultural land impacts had to be significant to remain "impacted". There was also a separate data spreadsheet developed for the agricultural lands for each alternative, which showed the hydroperiod differences in the Dry Season and Wet Season between each alternative and the ECB for each of the years analyzed (Dry Year 1989, Average Year 1978 and Wet Year 1995). An analysis was then conducted for the agricultural lands to determine what were significant and adverse conditions warranting acquisition of a real estate interest. Any increase in any Dry Season (November through April) of over 5 days was considered as requiring acquisition of a real estate interest (Criteria 2 above). For the Wet Seasons, the increase had to meet not only Criteria 3 above, but it had to increase the entire hydro-period to greater than 80 days. Once all this data was analyzed each parcel or percentage of the parcel was reviewed to determine if only a portion (and what portion) or all of the parcel would have to be acquired. Once the analysis was complete, the information was provided to Real Estate Division to provide a cost estimate.

The lands belonging to the Everglades National Park were not valued. The lands in the Frog Pond area were approved for acquisition under the C-111 South Dade project in the 1994 General Design Memorandum and will be provided as an item of local cooperation under that project. Therefore the real estate cost for lands required for each Alternative within the Frog Pond were not included under the C-111 Spreader Canal project real estate costs.

TABLE 5-2: FINAL ARRAY OF ALTERNATIVES

No-Action	Future Without Project Condition
Alternative 1C	Includes FPDA approximately 530 acres with maximum depth of 3 feet, pump for FPDA intercepts available water.
Alternative 1D	Includes FPDA approximately 530 acres with maximum depth of 3 feet, pump for FPDA intercepts available water, plus: one new operable structure in the lower C-111, incremental operational changes at S-18C, one plug at S-20A, operational changes at S-20, and 10 plugs located in the C-110 Canal.
Alternative 2DS	Includes FPDA approximately 530 acres with maximum depth of 3 feet, pump for FPDA intercepts available water, gravity structure upstream of S-177 to discharge into approximately half of the Aerojet Canal, plus: one new operable structure in the lower C-111, incremental operational changes at S-18C, one plug at S-20A, operational changes at S-20, and 10 plugs located in the C-110 Canal.
Alternative 2DL	Includes FPDA approximately 530 acres with maximum depth of 3 feet, pump for FPDA intercepts available water, gravity structure upstream of S-177 to discharge into the entire length of the Aerojet Canal, plus: one new operable structure in the lower C-111, incremental operational changes at S-18C, one plug at S-20A, operational changes at S-20, and 10 plugs located in the C-110 Canal.
Alternative 3D	Includes FPDA approximately 530 acres with maximum depth of 3 feet, pump for FPDA intercepts available water, pump upstream of S-177 to discharge into Aerojet Reservoir, plus: one new operable structure in the lower C-111, incremental operational changes at S-18C, one plug at S-20A, operational changes at S-20, and 10 plugs located in the C-110 Canal.
Alternative 6D	Construct seepage barrier from northern portion of L-31W (just west of S-332D) south along FPDA to the southern end of Aerojet Canal, plus: one new operable structure in the lower C-111, incremental operational changes at S-18C, one plug at S-20A, operational changes at S-20, and 10 plugs located in the C-110 Canal.

Note: A complete description and map of each alternative can be found in *APPENDIX F*.

After the hydrologic modeling was completed, the resulting data was post-processed and a Habitat Unit Evaluation (Benefit Evaluation) was conducted for each alternative. A Cost Effective/Incremental Cost Analysis (CE/ICA) was then carried out utilizing the newly calculated Habitat Units and Costs for the Final Array. The CE/ICA results were then combined with other evaluation criteria to evaluate and select a Recommended Plan.

The Benefit Evaluation Methodology, or Ecological Model, was subjected to a Model Certification review by an Expert Panel to ensure technical soundness in terms of theory and computational correctness. The Model Certification process resulted in slight changes to the three Performance Measures utilized for the Benefits Evaluation Methodology. These changes, requested by the Model Certification Expert Panel and agreed upon by the USACE, provided a more

accurate assessment of the ecological functions and processes as well as alternative performance. As a result, the Ecological Model for the proposed project was certified. *Section 5.3.8* provides a brief overview of the final Benefit Evaluation methodology and Habitat Unit calculations.

### 5.3.8 National Ecosystem Restoration Benefit Evaluation

#### 5.3.8.1 Description of Performance Metric Calculations

Benefits were estimated for each alternative using three hydrologic conditions (wet, dry, average) as simulated using the ModBranch model. *TABLE 5-3* includes the name and model run identifier for each of the alternatives. A description of each alternative is found in the formulation section of this report. Details regarding the hydrologic simulation efforts are found in the Engineering Appendices. Background information for each of the three performance metrics as well as the results of their application to the alternatives is provided below. The complete benefits assessment description and documentation is found in Appendix C.

TABLE 5-3: PROJECT ALTERNATIVES AND MODEL RUNS USED IN FINAL BENEFITS ANALYSIS

Alternative Name	Model Run
No Action Alternative Existing Conditions	FWO (Future Without Conditions)
Alternative 1C	ECB (Existing Conditions Baseline)
Alternative 1D	Alternative 1C
Alternative 2D Short	Alternative 1D
Alternative 2D Long	Alternative 2DS
Alternative 3D	Alternative 2DL
Alternative 6D	Alternative 3D
	Alternative 6D

#### 5.3.8.1.1 Performance Metric 1.5 Flow Timing, and Distribution of Volume

The Flow Timing, and Distribution of Volume performance metric is designed to characterize how much of the freshwater discharge flowing to tide from the Everglades is concentrated at Taylor Slough (i.e. moving toward central Florida Bay) and when, during the year, the discharges are occurring. *TABLE 5-4* shows results for PM1.5 when the three model run (1978, 1989, and 1995) results are equally weighted. The results for each of the three sub-indices (Timing, Distribution, and Volume) are shown along with the net hydrologic restoration units calculated for the with project alternatives. The overall Scenario HRU score for this performance metric is computed by taking the average of the three indices and multiplying this by the pre-drainage target

acreage (98,472). With equal weighting of the three sub-indices, alternatives 2DShort, 2DLong, and 3D score the highest for PM1.5.

A review of the sub-indices shows the relative contribution of each sub-index to the overall lift score. For future alternative conditions, the timing index varies from 88 to 93 percent agreement with the target flow timing conditions. This limited change in the hydrologic timing sub-index is a reflection of the lack of water storage features in any of the considered alternatives. Those alternatives with the greatest potential to retain or detain water score the highest in terms of achieving the timing target for Taylor Slough. For 6D, the cutoff wall likely prevents undesirable seepage losses from Taylor Slough drainage to the C-111 Canal perhaps in effect providing more in-ground storage of water than the other alternatives.

The future project condition results for the Taylor Slough Distribution sub-index shows a range from 85 to 88 percent agreement with the target flow distribution conditions. This sub-index shows little difference between the alternatives. The future with project condition results for the Taylor Slough Volume sub-index shows a range from 79% to 108% percent of NSM flows. Alternatives 2DShort, 2DLong, and 3D score the highest on the volume index as they appear to divert more water into the Taylor Slough transect (TA-1) than even the target (NSM) condition. Though alternative 6D scores relatively good in the timing and distribution sub-indices, it has a relatively low score for the volume sub-index. One conclusion that might be drawn from this is that features that passively retard flow (via a cutoff wall) must be augmented with dynamic pumping features in order to maximize habitat restoration. It appears that of the three PM1.5 sub-indices, the volume sub-index provides the greatest contribution of hydrologic lift as measured by the difference from the FWO condition. The PDT considered using a non-equal weighing scheme to sum up the contribution from the three sub-indices; however, the team felt that an equal weighting scheme was optimal since it equally favors three of the four CERP restoration goals (Quantity, Quality, Timing, and Distribution).

TABLE 5-4: RESULTS FOR PERFORMANCE METRIC 1.5 FLOW TIMING, DISTRIBUTION AND VOLUME

Simulation Year Weighting		PM 1.5 Area of Effect		9847	acres			
1978	33%							
1985	33%							
1995	33%							
ALTERNATIVE	Timing		Volume		Distribution		Total	Net from FWO
Sub-Indices Weight	0.33		0.33		0.33		1.00	
	% NSM	HRU	% NSM	HRU	% NSM	HRU	HRU	HRU
Pre-Drainage/Target	100%	32,824	100%	32,824	100%	32,824	98,472	
FWO	93%	30,581	88%	28,861	71%	23,372	82,814	-
Alt 1C	92%	30,278	85%	27,865	79%	25,924	84,068	1,254
Alt 1D	93%	30,403	87%	28,496	80%	26,174	85,073	2,259
Alt 2DS	89%	29,307	87%	28,601	102%	32,824	90,733	7,919
Alt 2DL	88%	29,037	87%	28,626	108%	32,824	90,487	7,673
Alt 3D	90%	29,418	87%	28,577	105%	32,824	90,818	8,004
Alt 6D	93%	30,641	88%	28,918	84%	27,683	87,243	4,429
ECB	95%	31,152	91%	29,899	73%	23,968	85,019	2,205

#### 5.3.8.1.2 Performance Metric 2.4 Coastal Zone Salinities

The stage-inferred coastal zone salinities measure characterizes how coastal embayment salinities vary during the year as estimated using stage-salinity relationships described by existing stage-based salinity regression equations provided by Everglades National Park (2006, Everglades National Park). *TABLE 5-5* shows results for PM 2.4 when the three model run (1978, 1989, and 1995) results are equally weighted. Results are provided for Barnes Sound, Manatee Bay, Joe Bay, Little Madeira Bay, and Long Sound nearshore areas. The overall Scenario HRU score is computed by multiplying the acreage of each nearshore area by the corresponding salinity index.

The results for Barnes Sound (BS) show that alternative 2DS performs somewhat better than the other future condition scenarios. The Manatee Bay (MB) show no difference between the future alternative conditions. This is a result of all predicted salinities ranging from 35 to 40 psu regardless of hydrologic conditions or alternative scenario. The results for Joe Bay indicate that alternative 2DShort provides the greatest lift to this area. The lift for

2DShort in Joe Bay is equivalent to about 10% of the FWO scenario HRU result. In Long Sound and Little Madeira Bay, the 2DLong, 2DShort, and 3D alternatives do marginally better than the other future scenarios. The resulting improved salinity conditions net HRUs for the with-project alternatives ranges from 287 for alternative 1D to 520 for alternative 2DShort.

The overall result for this performance metric shows that alternative 2DShort scores the highest in terms of meeting the desired salinity target derived from the natural systems hydrology. This alternative provides an increase of 4% over the future without condition and a 7% increase over the existing condition scenario. However, since increased S-197 discharges are generally considered harmful to Barnes Sound and Manatee Bay, and this metric does not directly measure the frequency or magnitude of releases through this structure, it is likely that this metric does not adequately capture undesirable impacts associated with excessive freshwater deliveries to a particular nearshore area.

TABLE 5-5: RESULTS FOR PERFORMANCE METRIC 2.4 COASTAL SALINITIES

Simulation Year Weighting		PM 2.4 Area of Effect		14,626	acres		
1978	33%						
1985	33%						
1995	33%						
Scenario	Individual Sub-Measure HRU Scores (Computed)					Sub-Measure Composite HRU Score	Net from FWO
	BS	MB	JB	LM	LS	Total	HRU
Pre-Drainage/Target	4,226	2,497	3,389	2,361	2,153	14,626	
FWO	2,813	2,392	1,990	1,900	1,370	10,465	-
Alt 1C	3,106	2,392	2,002	1,904	1,370	10,775	310
Alt 1D	3,083	2,392	2,002	1,904	1,370	10,752	287
Alt 2DS	3,160	2,392	2,101	1,930	1,402	10,986	520
Alt 2DL	3,130	2,392	2,108	1,930	1,402	10,961	496
Alt 3D	3,137	2,392	2,095	1,925	1,402	10,952	487
Alt 6D	3,137	2,392	2,046	1,921	1,374	10,871	405
ECB	2,960	2,392	1,718	1,805	1,241	10,115	(350)

## 5.3.8.1.3 Performance Metric 2.1 Vegetation Hydroperiods

The hydroperiod-inferred vegetation communities measure characterizes annual hydroperiods within defined indicator regions across the entire study area by describing how much of each indicator region (i.e., percent area) experiences a given hydroperiod (i.e., of 0 to 365 days; divided generally into 30-day hydroperiod classes/groupings). *TABLE 5-6* shows results for PM2.4 when the three model run (1978, 1989, and 1995) results are equally weighted. The Scenario HRU Score for each alternative is computed by taking the average of the three hydroperiod indices and multiplying this by the pre-drainage target acreage. As measured using this metric, under average hydrologic conditions, all of the with-project alternatives except alternatives 1C and 1D provide improved vegetation hydroperiod conditions relative to the No Action Alternative. Under average year conditions, only alternative 6D provides better hydroperiod conditions than the No Action Alternative. Under dry year conditions, most of the with-project alternatives perform only slightly better than the No Action Alternative. Alternative 6D is slightly worse than the FWO scenario under dry conditions. This is not a surprising result for any of the with project alternatives since during dry years there is very little water to be diverted or detained by project features. Under wet year hydrologic conditions,

alternatives 1C and 1D provide significantly less favorable hydroperiod results than the FWO scenario. Alternative 6D provides the most favorable hydroperiod results under wet hydrologic conditions. A review of the PM2.1 calculations shows that alternatives 1C and 1D do somewhat worse for Taylor Slough but significantly under perform in indicator region 3B under average and wet hydrologic conditions. Overall, alternative 6D provides the greatest HRU lift when PM2.1 is applied to all of the indicator zones.

TABLE 5-6: RESULTS FOR PERFORMANCE METRIC 2.1 VEGETATION HYDROPERIOD

Simulation Year Weighting		PM 2.4 Area of Effect		155,098	acres
1978	33%				
1985	33%				
1995	33%				
Scenario	Individual Sub-Measure HU Scores (Computed)			Sub-Measure Composite HU Score	Net from FWO HRU
	Avg	Dry	Wet		
Pre-Drainage/Target	51,699	51,699	51,699	155,098	
FWO	23,133	33,695	23,527	80,356	-
Alt 1C	19,172	33,788	20,767	73,727	(6,629)
Alt 1D	20,109	34,033	20,564	74,706	(5,650)
Alt 2DS	22,869	34,435	25,300	82,604	2,248
Alt 2DL	22,781	33,506	24,525	80,812	456
Alt 3D	21,561	34,301	24,457	80,319	(37)
Alt 6D	25,260	33,518	27,346	86,124	5,768
ECB	24,370	33,232	25,246	82,848	2,492

### 5.3.8.2 Aggregate Benefit Calculations

For each of the performance metrics, an overall result was computed by taking a simple average of the wet, average, and dry years. The team considered using a weighting system to combine the results from the three hydrologic conditions; however, since there are multiple ways in which these conditions could be defined (based on annual rainfall, based on seasonal rainfall, based on stage, based on structure flows based on habitat response to hydrologic conditions), the team determined that there was considerable uncertainty in assigning a return frequency (weighting) to each of the hydrologic conditions. To address the significance of weighting, a sensitivity analysis has been done to evaluate benefit estimates under different hydrologic condition weighting schemes. Aggregation

of individual performance metrics for the Target, the Baseline, and each Project Alternative condition, was done by adding the measure-specific habitat unit results for the three individual performance measures. Since two of the performance measures cover the same area (PM 1.5 and 2.1 both cover Taylor Slough), the results for individual performance measures are adjusted to remove double counting of project benefits so that the total acreage of benefited acreage computed by adding the three performance metric application acreages does not exceed the study area acreage (239,724 acres).

The resulting combined and normalized individual habitat unit scores are provided in *TABLE 5-7*. (The results in *TABLE 5-7* do not match the results for PM 1.5, PM 2.4, and PM 2.1 shown in *TABLE 5-4*, *TABLE 5-5*, and *TABLE 5-6* because when multiple PMs are used, the total net benefit is normalized to account for double counting of affected area that occurs when two or more PMs cover the same land area.)

**TABLE 5-7: OVERALL BENEFIT ASSESSMENT RESULTS**  
(Normalized to Account for Affected Area)

Simulation Year Weighting			Total Area of Effect (no double counting)			
1978	33%			239,724	acres	
1985	33%					
1995	33%					
Scenario	PM1.5 FlowTDV	PM2.4 Salinity	PM2.1 VegHydro	Total HRU	Adjusted HRU	Net FWO
Pre-Drainage/Target	98,472	14,626	155,098	268,196	239,724	
FWO	82,814	10,465	80,356	173,635	155,202	-
Alt 1C	84,068	10,775	73,727	168,570	150,674	(4,528)
Alt 1D	85,073	10,752	74,706	170,531	152,427	(2,775)
Alt 2DS	90,733	10,986	82,604	184,322	164,755	9,553
Alt 2DL	90,487	10,961	80,812	182,260	162,911	7,709
Alt 3D	90,818	10,952	80,319	182,089	162,758	7,556
Alt 6D	87,243	10,871	86,124	184,237	164,678	9,476
ECB	85,019	10,115	82,848	177,982	159,087	3,885

Note: The ten plugs in the C-110 Canal were included in the FWOP Condition and each alternative, including Alternative 1C. The ten plugs in the C-110 Canal were previously authorized as part of the C-111 SD project; however, a decision was made to include the C-110 plugs in the C-111 SC Western Project after benefit assessment model runs were conducted. As such, no benefit increase as a result of the plugs is realized over the FWOP Condition.

The results in *TABLE 5-7* indicate that 2DSshort provides the greatest lift while 1C and 1D both provides negative life relative to the No Action Alternative. Alternative 6D provides the second best lift while 2D Long provides somewhat less.

### 5.3.8.3 Discussion

In addition to the results presented here, a second line of evidence is presented in the benefits assessment section of *APPENDIX C*. This supplemental analysis was done as part of a risk and uncertainty analysis to ensure that the benefit results can be relied upon to indicate the most appropriate alternative for implementation. The supplemental analysis compares flows to Taylor Slough and Barnes Sound to assess the relative merit of each alternative. The supplemental analysis generally supports the results of the benefit assessment methodology in that Alternatives 2D Short and 2D Long are likely to provide more enhancement of habitat in Taylor Slough and Barnes Sound than would result from Alternatives 1C, 1D, or 3D. However, the benefits assessment methodology indicates that Alternative 6D provides benefits similar to 2D Short while the supplemental flow data analysis (S-197 flows) suggests that this alternative would cause substantial harm to Barnes Sound. Based on the combination of the benefits analysis and the second line of evidence, the benefit assessment results can be relied upon if the overall plan selection process indicates any alternative other than Alternative 6D. A discussion of sea level rise impact to project benefits is found in Section 7 of this report.

## 5.4 COST EFFECTIVE/INCREMENTAL COST ANALYSIS

Cost effectiveness and incremental cost analyses (CE/ICA) reveal information about good financial investments given the dollar costs and non-dollar outputs (“benefits”) of alternative investment choices for an ecosystem restoration project. This analysis is useful in lending support to identifying the National Ecosystem Restoration (NER) plan. The analyses are conducted in a series of steps that progressively identify alternatives that meet specified criteria and screen-out those that do not. USACE Engineer Regulation 1105-2-100 requires cost effectiveness and incremental cost analyses to support recommendations for ecosystem restoration.

A cost effectiveness analysis is conducted to ensure that least cost alternatives are identified for various levels of environmental output. Cost effectiveness analysis begins with a comparison of the annual costs and annual outputs of alternatives to identify the least cost plan for every level of output considered. Alternative plans are compared to identify those that would produce greater levels of output at equal or lower costs than other alternatives. Next, through incremental cost analysis (ICA), the cost effective alternative plans are compared to successively identify the alternative plans with the least additional cost per additional output that is, the plans that are the most efficient in production of output. The results of these calculations and comparisons of costs and outputs between alternative plans provide a basis for addressing the decision question “Is it worth it?” i.e., are the additional outputs worth the costs incurred to achieve them?

This analysis is based on and follows guidance from the USACE Institute for Water Resources publication, *Evaluation of Environmental Investment Procedures Manual, Interim: Cost Effectiveness and Incremental Analyses*, May 1995, IWR Report #95-R-1. As per this guidance, CE/ICA analysis compares the alternative plans' average annual costs against the appropriate average annual habitat unit estimates. The average annual outputs are calculated as the difference between with-plan and without-plan conditions over the period of analysis (through year 2050). The following sections present the average annual costs, average annual benefits and the results of cost effectiveness and incremental cost analysis for the alternative plans.

#### 5.4.1 Average Annual Costs

Data for initial construction/implementation, land acquisition, monitoring, and periodically recurring costs for operation, maintenance, repair, replacement, and rehabilitation (OMRR&R), have been developed through engineering design and cost estimation, and real estate appraisal efforts. Details of that data development are explained and discussed elsewhere in this report. The main issues requiring economic evaluation attention include equivalent time basis calculations, price levels, and timing of project spending.

For purposes of this report and analysis, NED costs (as defined by Federal and USACE policy), are expressed in October 2009 price levels, and are based on costs estimated to be incurred over a 40 year period of analysis. Costs of a plan represent the value of goods and services required to implement and operate and maintain the selected alternative plan.

The following table displays the costs associated with the alternatives. The costs presented in *TABLE 5-8* are preliminary rough order of magnitude (ROM) estimates and include total initial costs of construction features, real estate, interest during construction (IDC), and total average annual costs for each alternative. These costs were used to formulate and evaluate plans to identify the Recommended Plan. The costs for the Recommended Plan were further refined based on additional engineering and environmental evaluations, as noted in the main report and can be found in the MCACES cost estimates. The O&M cost is an annual estimate for fully implemented components.

The timing of a plan's costs is important. Construction and other initial implementation for component costs cannot simply be added to periodically recurring costs for project operation, maintenance, and monitoring. Also, construction costs incurred in a given year of the project cannot simply be added to construction costs incurred in other years if meaningful and direct comparisons of the costs of the different components are to be made. A common practice of equating sums of money across time with their equivalent at an earlier single point in time is the process known as discounting. Through this

mathematical process, which involves the use of an interest rate (or discount rate) officially prescribed by Federal policy for use in water resource planning analysis (4 5/8% at the time of analysis), the cost time stream for the alternative plans were mathematically translated into a equivalent time basis value.

There is some admitted uncertainty as to how the plan, if approved and adopted, would be implemented. It is recognized that the plan would likely be implemented over a considerable period of time, little by little. For purposes of this evaluation, construction costs are assumed to be incurred on an equal monthly basis during the implementation of the alternative plan as defined.

ER 1105-2-100 requires that IDC be computed which represents the opportunity cost of capital incurred during the construction period. Interest was computed for construction and PED costs from the middle of the month in which the expenditures were incurred until the first of the month following the estimated construction completion date. Interest during construction was computed for both real estate and construction costs. Interest during construction was computed for the total real estate cost starting from the month prior to construction commencing.

The cost of a project is the investment incurred up to the beginning of the period of analysis. The investment cost at that time is the sum of construction and other initial cost such as real estate and PED cost plus interest during construction. *TABLE 5-8* summarizes the total investment cost and total annual equivalent costs of each alternative plan.

TABLE 5-8: COSTS USED IN COST EFFECTIVENESS FOR PLAN SELECTION

	C-111 SC INVESTMENT COST					
	Alt 1C	Alt 1D	Alt 2DS	Alt 2DL	Alt 3D	ALT 6D
Total Construction (Including PED &S/A)	\$44,000,000	\$47,000,000	\$62,000,000	\$64,000,000	\$72,000,000	\$252,000,000
Construction Schedule (Months)	16	16	22	22	24	36
Real Estate	\$47,176,000	\$67,280,000	\$66,375,000	\$66,278,000	\$68,519,000	\$36,894,000
Certification for IDC (Months)	19	19	25	25	27	39
Total First Cost	\$91,176,000	\$114,280,000	\$128,375,000	\$130,278,000	\$140,519,000	\$288,894,000
IDC Construction	\$1,350,000	\$1,450,000	\$2,640,000	\$2,730,000	\$3,360,000	\$64,628,397
IDC Real Estate	\$3,500,000	\$4,990,000	\$6,560,000	\$6,546,352	\$7,340,000	\$5,840,000
<b>TOTAL INVESTMENT</b>	<b>\$96,026,000</b>	<b>\$120,720,000</b>	<b>\$137,575,000</b>	<b>\$139,534,352</b>	<b>\$151,219,000</b>	<b>\$359,362,397</b>
O&M	\$706,000	\$953,000	\$1,201,000	\$1,213,000	\$1,381,000	\$264,000
Period of Analysis	40	40	40	40	40	40
Annualization	\$5,312,000	\$6,680,000	\$7,610,000	\$7,720,000	\$8,360,000	\$19,880,000
<b>Average Annual Cost</b>	<b>\$6,018,000</b>	<b>\$7,633,000</b>	<b>\$8,811,000</b>	<b>\$8,933,000</b>	<b>\$9,741,000</b>	<b>\$20,144,000</b>

Note: Even though Alternative 2DL required more total land, Alternative 2DS impacted Real Estate lands further north than Alternative 2DL. These lands, due to the proximity to existing development, were assessed at a higher value than lands to the south that were impacted by Alternative 2DL. The reason for the difference in the location of impacted lands is because Alternative 2DS was shown to form a stronger hydraulic ridge with the limited amount of available water, thereby causing more intense groundwater mounding to the north.

#### 5.4.2 Ecological Evaluation

In practice, USACE ecosystem restoration studies typically measure the ecosystem benefits of alternative plans in terms of physical dimensions (number of acres of wetlands, for example), or population counts (number of wading birds, for example), or various habitat-based scores (habitat units based on the FWS's Habitat Evaluation Procedures, or "HEP", for example). This study uses habitat units that represent the ecological lift achieved by each alternative. In accordance with policy, the economic analysis of environmental restoration projects does not use monetary benefits when comparing alternative plans. Rather, environmentally quantified benefits are used.

This habitat unit lift is the primary benefit used by economists in the CE/ICA to determine best buys and cost-effectiveness among possible alternative plans.

A more thorough discussion of the habitat unit evaluation is located in this section and *APPENDIX C*.

##### 5.4.2.1 Average Annual Benefits

CE/ICA requires a comparison of average annual costs and average annual benefits. The average annual outputs were calculated as the difference between with-plan and without-plan conditions over the period of analysis (through year 2050). Costs and output used for the CE/ICA are displayed in *TABLE 5-8*. The

period of analysis for benefit amortization that was utilized is 40 years. The base year, or the first year benefits begin to accrue, is in 2010. The average annual habitat unit lift is calculated as subtracting the future without project habitat units from the future with project habitat units for each year and averaging over the period of analysis, which in this case is 40 years. Note that the output values shown reflect the differences between without project and with project on an average annual basis (i.e., ecological “lift” provided by each of the alternatives).

The analysis of ecological response times for large, diverse ecosystems is extremely difficult to calculate. For example, when analyzing an estuarine system, certain attributes would have to be examined when predicting the response to changes in salinity. Oysters may provide responses within a year of salinity change towards normal conditions. Seagrasses would normally respond quickly, but these responses are difficult to measure since there would be relocation of certain populations in response to specific currents and salinity concentrations. Small invertebrate and fish species should respond quickly; however, large vertebrate species would take longer to increase as they take longer to mature and reach reproductive ages.

The same difficulty occurs in the examination of freshwater systems. Different attributes, such as sawgrass marshes, periphyton mats, and bayheads respond differently in time to changes in hydroperiods and hydroperiods. Sawgrass marshes are in intense competition with other grasses, sedges and freshwater marsh species. Changes in the content of certain species could occur fairly rapidly in certain areas; however, the competition of populations and/or communities in others areas could take a much greater amount of time for species, populations and communities to become established. As such, the team took a linear approach to predict ecological response time for the three combined performance measures for both future without and future with project conditions. The ecological response time was estimated to be 10 years until full impact was realized.

The average annual habitat unit lift can be seen in *TABLE 5-9* below:

TABLE 5-9: AVERAGE ANNUAL HABITAT UNIT LIFT FOR SELECTED ALTERNATIVES

	Habitat Units (HU)	Average Annual HU Lift
Existing Condition (2010)	159,087	
Future Without (2050)	155,202	
Alternative 1C	150,674	-3,921
Alternative 1D	152,427	-2,402
Alternative 2DS	164,755	8,271
Alternative 2DL	162,911	6,675
Alternative 3D	162,758	6,543
Alternative 6D	164,678	8,205

The habitat units in the preceding table are plotted for a comparison of existing condition, future without and future with project conditions in *FIGURE 5-11*. The area under the curve between the existing-future without line and the existing-future with alternative lines is equivalent to the average annual habitat unit lift. As can be noted in the table the future without project condition is decreasing over the existing condition. All of the alternatives, with the exception of Alternatives 1C and 1D, are greater than the existing and future without project conditions.

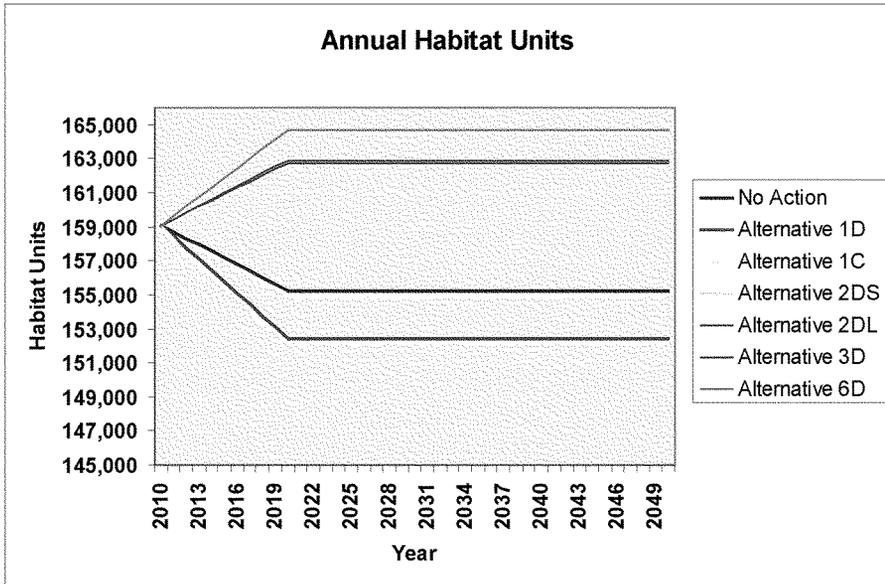


FIGURE 5-11: ANNUAL HABITAT UNITS

#### 5.4.3 Cost Effectiveness Analysis

Cost effectiveness analysis begins with a comparison of the annual costs and annual outputs of alternatives to identify the least cost plan for every level of output considered. Alternative plans are compared to identify those that would produce greater levels of output at equal or lower costs than other alternative plans. The three criteria for cost effectiveness screening:

1. The same output level could be produced by another plan at less cost;
2. A larger output level could be produced at the same cost; or
3. A larger output level could be produced at less cost.

The CE process involves arraying alternatives by increasing costs with their corresponding output. *TABLE 5-10* displays the final array of alternative utilized in the C-111 SC cost effectiveness analysis.

The lowest cost plan with positive output was identified as the first cost effective plan, in this case Alternative 2DS. The next plan (Alternative 2DL) was then compared against this plan. Since Alternative 2DS contains greater output than Alternative 2DL, this plan was not identified as cost effective. The remaining

plans were then be evaluated against this plan and so on. As can be seen from this analysis only one plan (Alternative 2DS) was identified as cost effective.

TABLE 5-10: FINAL ARRAY OF ALTERNATIVES UTILIZED IN THE C-111SC COST EFFECTIVENESS ANALYSIS

Alternative	Avg. Ann. Cost	Habitat Units	Cost Effective
Alternative 1C	\$6,018,000	-3,921	No
Alternative 1D	\$7,633,000	-2,402	No
Alternative 2DS	\$8,811,000	8,271	Best Buy
Alternative 2DL	\$8,933,000	6,675	No
Alternative 3D	\$9,741,000	6,543	No
Alternative 6D	\$20,144,000	8,205	No

The following graph contains a visual depiction of the cost effectiveness analysis. The graph plots the output of each plan against the cost of each plan.

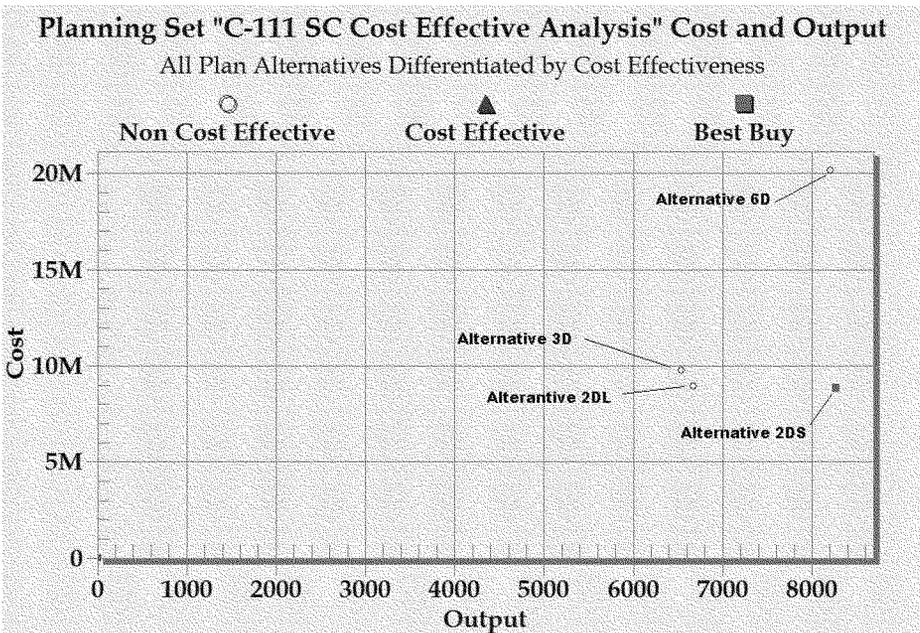


FIGURE 5-12: C-111 SPREADER CANAL ALTERNATIVE PLANS–COST EFFECTIVE/INCREMENTAL COST ANALYSIS RUN

#### 5.4.4 Incremental Cost Analysis

This section presents the results of incremental cost analysis for the C-111 SC Western project alternative plans for the optimization of the site. From the remaining cost effective alternatives, the plan with the lowest incremental costs per unit of output of all plans is the first best buy plan (Alternative 2DS). For C-111 SC only one plan was identified as cost effective alternative.

TABLE 5-11: FINAL ARRAY OF ALTERNATIVES UTILIZED IN THE C-111SC BEST BUY ANALYSIS

Alternative	Avg. Ann. Cost	Habitat Units	AAC/Habitat Unit	Cost Effective
Alternative 2DS	\$8,811,000	8,271	\$1,065	Best Buy

**TABLE 5-12** shows these results of the incremental cost analysis. The only best buy plan, Alternative 2DS, exhibits an incremental cost of \$1,065 per habitat unit, delivering a total of 8,271 average annual habitat units.

TABLE 5-12: RESULTS OF INCREMENTAL COST ANALYSIS: BEST BUY PLANS ARRAYED BY INCREASING OUTPUT BY INCREASING OUTPUT FOR COMBINED HABITAT (ALL PLANS)

Alternative	Average Annual Cost	Output	Average Cost Per Output	Incremental Average Annual Cost	Incremental Output	Incremental Cost Per Output
2DS	\$8,811,000	8,271	\$1,065	\$8,811,000	8,271	\$1,065

### 5.5 COMPARISON OF ALTERNATIVES

Based on the results of the Cost Effectiveness/Incremental Cost Analysis Alternatives 1C, 1D, 2DL, 3D, and 6D were screened from further consideration. None of these alternatives were Cost Effective or a Best Buy. A more exhaustive evaluation of these Alternatives is contained in the following paragraphs:

#### 5.5.1 Alternative 1C

Alternative 1C was neither Cost Effective nor a Best Buy. Additionally, Alternative 1C would not adequately meet the objectives for the proposed project. This alternative would not produce any environmental benefits above the Future without Project Condition and would be detrimental to the ecosystem compared to the No-Action alternative.

Alternative 1C was ineffective at reducing seepage out of Taylor Slough due to the size and configuration of the FPDA. The FPDA alone is not large enough to create a hydraulic ridge capable of retarding seepage out of ENP. Additionally, substantial seepage is likely occurring south of the FPDA, flowing around the small hydraulic ridge and continuing into the C-111 Canal.

The detrimental effects of Alternative 1C are due to the inefficient use of available water. Due to improper sizing, Alternative 1C is likely moving water across the project area with inopportune timing in an attempt to compensate for a lack of available water. The poor operational capacity is likely disrupting water distribution across the project area and causing hydroperiod fluctuations in the surrounding wetlands.

#### 5.5.2 Alternative 1D

Alternative 1D was neither Cost Effective nor a Best Buy. Alternative 1D would not adequately meet the objectives for the proposed project. Similar to Alternative 1C, it would be detrimental to the ecosystem compared to the No-Action alternative. Alternative 1D was ineffective at reducing seepage out of Taylor Slough due to the size and configuration of the FPDA. The FPDA alone is not large enough to create a hydraulic ridge capable of retarding seepage out of ENP. Additionally, substantial seepage is likely occurring south of the FPDA, flowing around the small hydraulic ridge and continuing into the C-111 Canal. Alternative 1D is offset by the inclusion of the "D" series features and as a result performs better than Alternative 1C. The "D" series features work to raise groundwater levels across the eastern portion of the project area, and therefore serve to reinforce the hydraulic ridge that is being created.

The detrimental effects of Alternative 1D, although not as severe as Alternative 1C, are also due to the inefficient use of available water. Due to improper sizing, Alternative 1D is likely moving water across the project area with inopportune timing in an attempt to compensate for a lack of available water. The poor operational capacity is likely disrupting water distribution across the project area and causing hydroperiod fluctuations in the surrounding wetlands. As stated above, the "D" series features increase alternative performance but are not enough to overcome inadequate alternative features.

#### 5.5.3 Alternative 2DL

Alternative 2DL was neither Cost Effective nor Best Buy. Alternative 2DL would produce a greater number of environmental benefits than Alternatives 1C and 1D due to the inclusion of an Aerojet Canal feature; however, this alternative would not make optimal use of available water for the proposed project. Because the size (length) of the Aerojet Canal feature is too large (long), the limited amount of water is spread too thin to maintain an effective hydraulic

ridge. The Habitat Unit output for the Alternatives demonstrates that Alternative 2DS, with a smaller (shorter) Aerojet Canal feature, is much more effective at utilizing the available water for the project and also maintaining a stronger hydraulic ridge that blocks seepage.

Although there has been no consultation with the USFWS on this alternative, the southern portion of the Aerojet feature in this alternative would require a construction footprint directly in Critical Habitat for the Cape Sable seaside sparrow. Additionally, there are concerns from the State of Florida regarding wetland impacts that would result from the construction of the southern portion of the Aerojet features.

#### 5.5.4 Alternative 3D

Alternative 3D was neither Cost Effective nor a Best Buy. Alternative 3D would produce more environmental benefit than Alternatives 1C and 1D due to the addition of the Aerojet Reservoir feature; however, there is a lack of available water to efficiently operate the larger reservoir feature. The reservoir is too large to be completely filled with water on an optimal basis, leading to water being spread too thin to maintain an effective hydraulic ridge. As such, more seepage occurs in this alternative when compared to Alternative 2DS.

There are also concerns from the State of Florida regarding wetland impacts that would result from the construction of the Aerojet Reservoir. These wetland impacts are avoidable as other alternatives demonstrate that utilization of the existing Aerojet Canal feature is sufficient for project purposes. Additionally, the likely construction footprint could possibly have detrimental effects on Critical Habitat for the Cape Sable seaside sparrow.

#### 5.5.5 Alternative 6D

Alternative 6D was neither Cost Effective nor a Best Buy. Alternative 6D would produce the second greatest amount of environmental benefits when compared to the other alternatives; however, the cost of Alternative 6D is approximately 3.5 times larger than that of the next highest cost alternative.

Although Alternative 6D would meet the project objectives, it would not be a flexible alternative and would therefore violate the constraints. Alternative 6D would consist of a permanent, in-ground seepage barrier. A requisite goal of the C-111 SC Western project is to incorporate IAR principles for adaptive management as the C-111 SC Eastern project will likely require a balancing of water for restoration across the entire project area. Without maintaining flexibility, it will be difficult to redistribute the appropriate quantities of water to achieve the optimal environmental restoration of this portion of the Everglades system.

There is a great deal of risk associated with the construction of a massive, permanent Seepage Barrier in a two-part implementation project. There is a possibility that the Seepage Barrier may not conform to future recommendations for the C-111 SC Eastern project, requiring removal of part of or the entire structure. Deconstruction of the seepage barrier would cause a great deal of environmental degradation, requiring additional plans to restore this area, if it is possible at that point. Additionally, deconstruction would require funding supplementary to the plan recommended for the future restoration project.

Although there has been no consultation with the USFWS on this alternative, the southern portion of the Seepage Barrier in this alternative would require a construction footprint directly in Critical Habitat for the Cape Sable seaside sparrow. Also, supplemental data from the environmental evaluation suggests that Alternative 6D would cause substantial damage to Barnes Sound.

#### 5.5.6 Examination of Further Evaluation Possibilities

Due to the range of output resulting from the alternatives, additional analysis was conducted to determine if further "bracketing" could be performed to establish a more efficient and effective alternative. Two conceptual alternatives configurations were formulated that would have an increase and decrease of the length of the Aerojet Canal feature. The two Conceptual Alternatives and configurations are noted below:

Alternative	Configuration
Conceptual Alternative A	25% Aerojet Canal
Alternative 2DS	50% Aerojet Canal
Conceptual Alternative B	75% Aerojet Canal
Alternative 2DL	100% Aerojet Canal

Conceptual Alternative A would be similar to Alternative 2DS with an even smaller Aerojet Canal feature. There would not be any substantial change in cost between the two alternatives, as most of the necessary construction work for Alternative 2DS would still be needed for Alternative A. Earthen plugs would still be necessary in the L-31W Connector Canal, and all plugs in the lower Aerojet Canal would also be necessary to ensure proper function of the hydraulic ridge. Alternative 2DS would likely produce more benefit than Alternative A with a negligible difference in cost. As such, Alternative A would not have been cost-effective and was not considered for inclusion.

Conceptual Alternative B, with a larger Aerojet Canal feature than alternative 2DS but smaller than that of Alternative 2DL, would experience the same shortcomings as Alternative 2DL due to excessive Aerojet Canal length. Alternative B would experience extended periods of water unavailability, and

the pumps would only operate on a part-time basis. Similar to Alternative 2DL, benefits would only be produced during periods of substantial flow during the wet season when the detention area could be filled to capacity. Additionally, Alternative B would require construction in extremely close proximity to Cape Sable Seaside Sparrow Critical Habitat, and would have an increased likelihood for detrimental impacts to the CSSS through flooding. Due to these similarities to Alternative 2DL performance, Conceptual Alternative B was not considered for inclusion.

#### 5.5.7 Evaluation of Remaining Alternatives

As a result of the CE/ICA and Screening Analysis, two Alternatives remained to be evaluated. These two Alternatives are listed below and evaluated in the following paragraphs:

- No-Action (FWOP Condition)
- Alternative 2DS

#### 5.5.8 No-Action (Future Without Plan Condition)

The No-Action Alternative would lead to continued environmental degradation in the proposed project area. Ecosystem function was estimated to decline by 3,885 Habitat Units. Seepage losses from Taylor Slough would continue with deteriorating effects on the primary deepwater system and its tributaries. The C-111 and associated canals would continue to produce damaging effects on the adjacent wetlands, leading to increased soil subsidence and continued negative shifts in vegetative communities. The altered hydroperiods would allow for the colonization of new areas by exotic species of vegetation, further altering the landscape.

#### 5.5.9 Alternative 2DS

Alternative 2DS is both Cost Effective and a Best Buy. Alternative 2DS would do the best job of meeting the project objectives and would not violate any of the constraints for the proposed project. Alternative 2D would also produce the greatest amount of benefits when compared to the rest of the Final Array. This alternative has the most optimal Aerojet Canal feature configuration, and is the most effective alternative in creating a hydraulic ridge to reduce seepage out of Taylor Slough. Alternative 2DS presents a low amount of risk and uncertainty. By utilizing the existing Aerojet Canal for a project feature, any necessary alterations for the future C-111 SC Eastern project should be minimal, requiring a smaller amount of cost and disturbance to the project area.

Alternative 2DS would provide immediate restoration benefits by enabling the Taylor Slough area to retain rainfall, water and inflows that are currently being

lost through seepage to the C-111 Canal. Although some impacts would occur to the wetlands within the central portion of the project area, these effects are expected to be minimal and temporary in nature. The beneficial effects of the proposed project greatly outweigh any slight negative consequences that will occur. The wetlands that would be impacted are located along the C-111 Canal and have already experienced a disrupted, unnatural hydroperiod.

Alternative 2DS is both an effective and efficient plan. Alternative 2DS would also be an acceptable plan that is both workable and viable with other agencies and the public. This alternative is also compatible with existing law and policy.

TABLE 5-13: COMPARISON CRITERIA OF REMAINING ALTERNATIVES

Comparison Criteria	Alternatives	
	No-Action (FWOP)	Alternative 2DS
Achieves the project goals and objectives	Does not meet the project goals and objectives	Does the second best job of meeting project goals and objectives
Meets Constraints	Would not violate the constraints	Would not violate the constraints
IAR Principles	Would not incorporate IAR Principles	Would incorporate IAR Principles
Cost Effectiveness	Cost Effective and a Best Buy	Cost Effective and a Best Buy
Risk and Uncertainty	No risk and uncertainty	Low risk and uncertainty
Effects on the Environment	Would likely lead to environmental degradation through further development, elimination of habitat, etc.	Would produce beneficial effects on the environment
Effectiveness	Ineffective	Effective at meeting goals and objectives
Efficiency	Cost Effective and a Best Buy	Cost Effective and a Best Buy
Acceptability	Acceptable; Is feasible and implementable	Workable and Viable with Other Agencies and Public; Compatible with Existing Law and Policy
Completeness	Complete	Complete; Addresses present and future restoration opportunities in the project area

## 5.6 SUMMARY OF OUTPUTS OF THE FOUR ACCOUNTS

While the CE/ICA of the various alternatives in obtaining habitat outputs is the primary evaluation technique in the selection of the NER plan. Engineering Circular (EC) 1105-2-409 states the following regarding plan selection: Any alternative plan may be selected and recommended for implementation if it has, on balance, net beneficial effects after considering all plan effects, beneficial and adverse, in the four Principles and Guidelines evaluation accounts (National Economic Development (NED), Environmental Quality (EQ), Regional Economic Development (RED), and Other Social Effects (OSE)).

This section provides a full discussion and display of the beneficial and adverse effects of each plan, and a comparison of costs and effects among plans as well as cumulative effects.

### 5.6.1 National Economic Development

NED benefits are defined as increases in the economic value of the goods and services that result directly from a project. These are benefits that occur as a direct result of the project but are national in perspective. Benefit categories considered in the C-111 SC Western project analysis include recreation, water supply and flood control. While these three categories represent important national considerations the project was not formulated to maximize NED benefit streams. As such, NED benefits of the C-111 SC Western project would be classified as incidental. Water supply and Flood Risk Management benefits would be included only as a qualitative discussion. A Recreation plan and associated benefit quantification has been included for this project in Section 6 of the PIR; however, the Recreation Plan was formulated and incrementally justified after the identification of the Recommended Plan.

### 5.6.2 Environmental Quality

The Environmental Quality outputs for the C111 SC Western project were portrayed as habitat outputs/units and were assessed for the CE/ICA in the previous sections. A more thorough discussion of the Environmental Evaluation is contained in *APPENDIX C* of this PIR.

### 5.6.3 Regional Economic Development

Alternatives 2DS is anticipated to provide Regional Economic Development (RED) benefit from the expenditures of construction dollars in the local economy. In particular the construction of any recommended features would have a beneficial effect on employment and demand for local goods and services during the construction period. In the absence of a project there would be no expenditures and therefore no RED benefits. *APPENDIX G* contains the

economic impact the construction expenditures Alternative 2DS has on employment, output (sales) and employee compensation (income). The impact is expected to be limited to the years during construction. The No-Action Alternative would not provide any RED benefits.

#### 5.6.4 Other Social Effects

Alternatives 2DS as well as the No-Action Alternative, could result in beneficial and adverse OSE within the study area. The alternative restoration plans could have positive or adverse OSE impacts on the study area associated with 1) plan implementation, including land acquisition, project construction, and O&M activities, and 2) operation of the modified C&SF system. As in the case of the NED effects, the OSE account is concerned with the net effects of the alternative plans (i.e., the differences between the with- and without-project future conditions).

Some of the potential OSE impacts would occur primarily at the regional scale, and others would have more localized effects. At both scales, there may be some individuals and communities that are positively affected by project implementation, some that are adversely affected, and many that are not affected at all. Relative to the size of the regional or local economies, the OSE effects may be minimal. However, if these effects occur predominantly within a limited geographic area, or affect a relatively small or vulnerable population, then the impacts can be disproportionately large. Therefore, the purposes of OSE analysis include not only determining the total magnitude of potential impacts, but also identifying the population (and its characteristics) that would be affected by any proposed action.

Some of the categories of effects typically included in the OSE account do not pertain to the alternative restoration plans. For example, the alternative plans are not expected to affect energy use or energy conservation in the study area. As will be noted, other categories of potential OSE impacts have been addressed and can be found in *APPENDIX G*.

Potential areas of social effects have been assessed as part of the study process. The key areas analyzed to date are prime and unique farmland, environmental justice, cultural resources and recreational benefits and costs. Relatively similar impacts would be anticipated for all alternatives.

##### 5.6.4.1 Prime and Unique Farmland

Consultation with the NRCS, in a letter dated 10 December 2008, has determined that no Prime Farmland Soils are within the project area. The NRCS has further designated that the project area does not contain any Prime,

Unique, Statewide, or Locally important farmland. This project, therefore, is in full compliance with the Farmland Protection Policy Act of 1981.

#### 5.6.4.2 Environmental Justice

The USACE evaluated environmental justice requirements per Executive Order (E.O.) 12898.

The C-111 SC Western project is in compliance with E.O. 12898, Environmental Justice, which requires the federal government to achieve environmental justice by identifying and addressing disproportionately high adverse effects of its activities on minority or low-income populations, and by involving potentially affected minorities in the public coordination process. No minority or economically disadvantaged population clusters have been identified in the immediate southern Miami-Dade County region where project features are proposed. The proposed features do not present any environmental impacts that are high, adverse and disproportionate to low income, minority or tribal populations. Stakeholder meetings with minority groups took place in 2003 to address concerns.

#### 5.6.4.3 Cultural Resources

The USACE is reviewing information regarding historical properties that might be affected by the C-111 SC Western project, in compliance with Section 106 of the National Historic Preservation Act of 1966 (PL 89-665), as amended in 2006; its implementing regulations (36 CFR Part 800) and the Archaeological and Historic Preservation Act of 1974 (PL 93-291), as amended.

A review of the Florida Master Site Files indicated several known archaeological sites and the probability of unrecorded sites within the C-111 SC Western project area. A Phase I cultural resources survey was conducted in the APE. The survey identified a single historic resource (8DA11433), a limestone road likely constructed in the 1930s. It is not considered eligible for the National Register of Historic Places. With the concurrence of the State Historic Preservation Officer, the USACE has determined that the planned undertaking will have no effect on any significant cultural resources. This determination has been made in compliance with Section 106 of the National Historic Preservation Act of 1966 (PL 89-665), as amended; its implementing regulations (36 CFR Part 800) and the Archaeological and Historic Preservation Act of 1974 (PL93-291), as amended.

If during project development, unanticipated discoveries are made, construction will stop and the USACE archeologist, State Historic Preservation Officer, and consulting Tribes will be notified. If these unanticipated discoveries include human remains, this would also require notification of the state archeologist in

compliance with Chapter 872.05, Florida Statutes, or the county medical examiner if the remains are less than 75 years old.

#### **5.7 IDENTIFICATION OF THE NATIONAL ECOSYSTEM RESTORATION PLAN**

After conducting an analysis of the Final Array of Alternatives and using information gathered from the Cost Effective/Incremental Cost Analysis and evaluation of the four accounts, Alternative 2DS was selected as the NER plan as it reasonably maximizes the amount of environmental restoration compared to costs. This alternative is an economically viable solution to the problems identified for the proposed project and would produce significant and meaningful habitat unit lift. Although not necessary for selection as the NER plan, it is important to note that Alternative 2DS would have the lowest cost per unit of output of any alternative in the Final Array.

#### **5.8 PLAN SELECTION**

Alternative 2DS is the NER Plan and has been selected as the Recommended Plan for the Western PIR. Alternative 2DS would do the second best job of meeting all of the project objectives when compared to the other plans in the Final Array of Alternatives. Alternative 2DS would provide for the restoration of the quantity, timing, and distribution of water delivered to Florida Bay via Taylor Slough, resulting in a return of the ecosystem to more historic conditions. Hydropatterns and hydroperiods in the Southern Glades and Model Land would be improved, resulting in the restoration of vegetation patterns in historical sloughs and associated tributaries. Additionally, salinity conditions would be improved in Little Madeira Bay and Joe Bay. Both Little Madeira Bay and Joe Bay are main receiving waters of flows from Taylor Slough into Florida Bay.

Alternative 2DS would also conform to the principles of Incremental Adaptive Restoration. This Alternative would provide immediate environmental restoration while also producing measurable conditions that will be utilized for the planning and implementation of the Eastern PIR.

Alternative 2DS is both Cost Effective and a Best Buy, and completely addresses all necessary criteria to provide for realization of the proposed project effects. This Alternative is acceptable to state and local agencies as well as the public, and is also compatible with all applicable law and policy.

## 5.9 RISK AND UNCERTAINTY

### 5.9.1 Benefit Assessment

As assessment of the Risk and Uncertainty associated with the Benefit Assessment is contained in *APPENDIX C* of this document under the Benefit Methodology Section. The assessment includes an evaluation of the ModBranch model that was utilized for this proposed project as well as the performance metrics that were used to calculate habitat units.

### 5.9.2 Adaptive Management

The CERP adaptive assessment policy will be utilized to refine and improve the desired project performance of the Recommended Plan. For the C-111 SC Western project, the IAR strategy, a subset of the adaptive management strategy, will also be implemented to achieve more project-specific results that cannot be attained through a broader AM strategy. The AM strategy for the C-111 SC Western project will primarily serve to reduce uncertainties related to the effects of CERP projects on the natural system. The strategy will be imperative in guiding the order and schedule for other CERP project implementation.

### 5.9.3 Effects of Water Redistribution

As the Recommended Plan would provide for the redistribution of a limited amount of water across the proposed project area, there may be unintended effects to some areas within the study area. The central portion of the project area will possibly experience some drawdown effects as more water is withdrawn from the C-111 Canal to retain water in Taylor Slough.

Additionally, the benefit analysis indicates there could be a decline in salinity conditions for the eastern portions of Florida Bay as more water is redistributed to the western portion of the project area. The salinity performance measure that was utilized for the project was approved for use by RECOVER; however, the measure is still highly inadequate and is not based on freshwater flows into Florida Bay. As such, the performance measure provides an inexact measurement of wetland stage related to salinity in the estuaries. The performance measure does not include any consideration of groundwater input to Florida Bay. The increase in groundwater flow into the Bay as a result of the project is expected to be substantial, but there is currently a lack of scientific research data regarding the magnitude and location of these flows. Additionally, the Modbranch model that was utilized for the project does not have the capability to measure salinity changes in the Bay. The inadequacy and poor reliability of this performance measure to predict effects in the estuaries has been thoroughly discussed in the DPIR in Section 5 as well as Appendix C.

It is anticipated that any possible negative effects to the project area will be temporary in nature and will be offset through the monitoring and adaptive management plans for the proposed project. Additionally, the “D” series features should also contribute to offset any possible drawdown effects in the Southern Glades and Model Land. Any possible negative effects that may occur as a result of project implementation that cannot be rectified through adaptive management will be addressed in the C-111 SC Eastern project.

#### 5.9.4 Ecological Response Time

Although benefits would commence immediately with the reduction of seepage losses from Taylor Slough and the increased overland flow, the transitions associated with changes in vegetative communities would be more gradual and increase over time as the hydropatterns and hydroperiods within the natural system are altered. Competition between vegetative communities would occur gradually as the system becomes accommodated to hydrological change. Additionally, although the changes in flow to eastern Florida Bay would immediately begin to reduce the hypersalinity, increases in juvenile fish reproduction and survivability would not be evident until populations stabilize and life cycles are completed. Additionally, the colonization and establishment of healthy SAV communities would not be immediately evident unless intensive plantings and maintenance were performed. As such, a temporary lag period of 10 years was utilized for the annualization of estimated project benefits.

#### 5.9.5 Project Features

The proposed project has been designed in accordance with IAR principles in order to eliminate decision critical uncertainties. There is minimal risk and uncertainty associated with the features designated to produce the predicted ecosystem restoration benefits. The actual spreader canal feature that was proposed as part of the Yellow Book plan will not be constructed as part of the C-111 SC Western project. A Spreader Canal Design will instead be implemented outside the authority of this PIR under the CERP Engineering and Design Agreement. This temporary Design Test will serve to eliminate the uncertainties related to the construction and operation of a spreader canal, including any water quality concerns within the vicinity of the proposed test. The results of the Design Test will be utilized along with information gained from the construction and implementation of the C-111 SC Western project to formulate, evaluate, and design alternative plans for the future C-111 SC Eastern project. It is anticipated that the Spreader Canal will be a major restoration component of the future project plan.

### 5.9.6 Construction Cost Estimate Contingencies

The Micro-computer Aided Cost Engineering System (MCACES)/MII cost estimate on the Recommended Plan will be refined as the design of the plan is refined between the generation of the Alternative Formulation Briefing (AFB) materials and the time the final PIR is approved. During this time, the risk analysis will be refined. The risk analysis will be performed according to Engineering and Construction Bulletin, No. 2007-17, September 10, 2007, and any subsequent guidance on risk analysis. All work products (cost estimate and risk analysis) will be reviewed under current Independent Technical Review (ITR) procedures, including the separate cost estimate review (presently conducted by Walla Walla District).

### 5.9.7 Real Estate Cost Implications

Because of relatively high regional real estate costs, ecosystem restoration projects within the south Florida Everglades may require larger real estate expenditures than similar-sized projects in other geographical regions of the country. Land values in south Florida have historically been quite fluid in response to speculation, a situation which has historically been exacerbated by an overall lack of developable land. It is possible that lands targeted for acquisition may exceed projections once the proposed project is authorized and funds are appropriated. As such, it is important to recognize that there is a degree of uncertainty related to overall estimated real estate costs associated with the Recommended Plan. A detailed real estate analysis is provided in the ***REAL ESTATE APPENDIX D***.

## 5.10 COLLABORATIVE PLANNING

The C-111 SC Western project presented an opportunity for the USACE to expand beyond traditional project-level implementation planning in an effort to introduce new problem-solving capabilities. Given the critical uncertainties that were identified, the planning process for the proposed project has been extended beyond the PDT to include a more broad public review of technical analyses. This collaborative approach, as identified in Engineering Circular 1105-2-409, will be utilized to ensure quality control at the highest level.

A Collaborative Planning Workshop was held in February 2008 at the SFWMD. Senior Agency Leadership representatives as well as concerned public entities met to discuss the Recommended Plan for the proposed project.

### 5.10.1 Design Optimization

The majority of the attendees agreed that the largest detriment to the health of eastern Florida Bay was the loss of seepage from the Taylor Slough area to the

C-111 Canal, specifically in the reach between S-18C and S-177. There was consensus that the hydraulic ridge proposed by the PDT would provide the most benefit to eastern Florida Bay as a result of any project proposals. The group recommended that the PDT explore other design possibilities to further decrease seepage losses. The recommendations included the possibility of utilizing the L-31 West Canal similar to designs for the Aerojet Canal. Other recommendations included consolidating the two proposed pump stations into a single pump station. This concept mirrored some that were proposed in a Value Engineering Study conducted for the proposed C-111 SC Western project.

#### 5.10.2 Coordination Among Project Teams

There are currently other projects within the vicinity of the C-111 SC Western project that could provide added benefit through coordination of project features and operations. The group noted that coordination between the C-111 South Dade project team and the C-111 SC PDT was important to maintain continuity across restoration proposals. As such, the USACE and SFWMD maintained constant coordination between both of the aforementioned project teams.

#### 5.10.3 Monitoring

The group stressed the importance of learning from the C-111 SC Western project and indicated that increased monitoring is imperative, despite an increase in estimated costs. Close monitoring in Taylor Slough and Florida Bay would be essential in creating measurable effects of the desired benefits. Monitoring in the Frog Pond Detention Area and associated features creating a hydraulic ridge are important in tracking the ground water flows, which is essential to the adaptive management of these features. The conclusion of the workshop produced agreement that the collaborative approach had promoted solidarity amongst all involved parties and helped to ensure that all issues were raised and addressed for the benefit of the proposed project.

SECTION 6  
THE RECOMMENDED PLAN

## 6.0 THE RECOMMENDED PLAN

The Recommended Plan for the C-111 SC Western project is Alternative 2DS. The Recommended Plan reasonably maximizes restoration benefits compared to costs, is cost effective and a best buy, and provides opportunities to reduce the decision critical uncertainties necessary to plan and evaluate the C-111 SC Eastern features. The Recommended Plan is consistent with project goals and objectives, is estimated to have a total project first cost of \$161,044,000 (does not include sunk PIR costs which total \$1,080,000), and annual costs associated with vegetation management, endangered species act monitoring, and project level monitoring, as per pending ASA(CW) policy guidance have been identified.

The recommended plan is primarily intended to improve the quantity, timing, and distribution of water delivered to Florida Bay via Taylor Slough. These improvements will occur by establishing a hydraulic ridge between Taylor Slough and the C-111 Canal, to prevent or reduce seepage losses from Taylor Slough and its headwaters. The hydraulic ridge will be established by the diversion of water from the C-111 Canal to the existing Aerojet Canal and an above ground detention area to be constructed on Frog Pond lands owned by SFWMD. Marsh stage triggers in Taylor Slough and the adjacent wetlands will be used to manage pumping rates into the FPDA and the Aerojet Canal. Two additional features will be implemented to promote additional groundwater mounding south of the Frog Pond lands and Aerojet Canal. The two features include the construction of one new operable structure in the lower C-111 Canal and incremental changes at existing structure S-18C.

Although the recommended plan's primary focus is on the improvement of flows to Florida Bay via Taylor Slough, the plan is also intended to improve wetland hydroperiods and hydropatterns in the Southern Glades and Model Land. This will largely be accomplished by modifications to current operations at structure S-20, the installation of an earthen plug in the L-31E Canal near S-20A, and the installation of ten earthen plugs in the C-110 Canal. Additionally, the Recommended Plan includes Recreational components, a Project Monitoring Plan, a Draft Project Operating Manual, and an OMRR&R plan.

### 6.1 DESCRIPTION OF PLAN COMPONENTS

#### 6.1.1 Frog Pond Detention Area

As currently envisioned, water that otherwise would be discharged via S-177 is routed to the proposed above ground, 590 acre Frog Pond Detention Area (FPDA) via a proposed S-200 pump station (225 cfs) to be constructed downstream of S-176. The FPDA is designed to meet the requirements of a Low Hazard Potential Facility. The perimeter containment levee has an elevation of +9.0 feet NAVD88. The average height above existing ground elevation is about

5.5 feet. The S-200 pump station, which will trigger at stages slightly lower than S-177's current open criteria [Interim Operational Plan (IOP)] will discharge to a concrete-lined, aboveground, conveyance channel, that discharges to an aboveground, cascading header channel located along the western side of the proposed aboveground FPDA.

The cascading header channel will assist in prevention of seepage losses from Taylor Slough and will ensure that available water is staged higher prior to discharge into one of three individual cells within FPDA. Cascading water levels will be maintained by constructing two 80-foot long east-west weirs at 1/3 points along the length of the header canal. The weir crest elevations are set to be 0.5 ft above existing ground elevation.

Just upstream of the two header weirs and just upstream of the southern levee of the southern detention area cell, 80-foot long north-south weirs will be constructed between the header canal and FPDA cells. The weirs crest elevations are set to be 1.2 ft above existing ground elevation.

Note: Planning level design of the FPDA was established at 530 acres for alternative comparison purposes. The size of the FPDA has increased to 590 acres after preliminary detailed modeling and design.

#### 6.1.2 Aerojet Canal

Similar to the FPDA, water that otherwise would be discharged via S-177 is routed to the Aerojet Road Canal that is proposed to be extended several thousand feet to the north. The northern limit of the existing Aerojet Canal presently lies approximately one mile south of Ingraham Highway. Although plugged at various locations, its overall length currently extends a distance of approximately 4.6 miles. It is proposed to effectively extend the northern limit of the canal to a point approximately 2,300 feet south of State Road (SR) 9336 as an unlined above ground open channel, to construct a concrete-lined above ground channel between the northern canal extension and S-199, construct perimeter grading around all unlined portions of the canal north of the east-west borrow canal, construct a new earthen weir with crest elevation 1.0 foot below adjacent natural ground, and convert all existing plugs over that same length to similar weirs. A second, S-199 pump station (225 cfs), will have the same triggers as S-200 and will be constructed immediately upstream of S-177 (downstream of State Road 9336). S-199 will discharge into a concrete-lined, aboveground channel which will be constructed parallel to (south of) SR 9336. The conveyance channel will, in turn, discharge to an above ground, unlined, northern extension of the Aerojet Canal.

The intent of the Aerojet Road Canal features is to extend the hydraulic ridge created by the FPDA south of SR 9336, thus reducing Taylor Slough seepage

from what is reportedly the leakiest section of the C-111 Canal system. The reduction of seepage losses keeps water within the natural system, increasing project benefits. Similar to the FPDA header canal, cascading water levels will be maintained within the Aerojet Road Canal by converting 3 existing earthen plugs to broad crested weirs and construction of a new broad crested weir. The crest elevations will be 1 foot below adjacent existing grades, and the canal will include sufficient freeboard to prevent levee bank from being overtopped.

### 6.1.3 Secondary Water Control Features

#### 6.1.3.1 One Operable Structure in the Lower C-111 Canal

The plan also includes the construction of an operable structure within the lower C-111 Canal. The proposed structure is intended to create groundwater mounding, thereby reducing current levels of seepage from the lower C-111 Canal while preserving existing levels of flood damage reduction.

#### 6.1.3.2 Incremental Operational Changes at S-18C

In order to maximize restoration opportunities, the plan includes incremental operational changes in the current “open and close” triggers at existing structure S-18C. The “open and close” triggers will be increased in increments of no more than 0.1-foot per year and the total change in either trigger shall not exceed 0.4-feet. Stage override triggers will be established immediately downstream of S-177 and/or in the adjacent agricultural lands to establish a “backstop” at which S-18C triggers will return to their existing levels. The incremental operational changes at S-18C will serve to supplement groundwater mounding in the lower C-111 area.

#### 6.1.3.3 Plug at S-20A and Operational Changes at S-20

The plan includes the construction of a permanent plug at existing structure S-20A in the L-31E Canal, and operational changes at existing structure S-20. The proposed plug near S-20A and proposed operational changes at S-20, specifically raising the “open and close” triggers to 0.5-feet, are intended to restore hydroperiods within the Model Land.

#### 6.1.3.4 C-110 Canal Plugs

Finally, the plan includes construction of earthen plugs at key locations within the C-110 Canal in order to promote sheet flow within the Southern Glades. As currently envisioned, ten plugs will be constructed at semi-regular intervals by returning the existing spoil material from the canal banks to the canal. Any remaining spoil not utilized in construction of the plugs will be placed into the

canal to further promote sheetflow and to lessen the effects of the of any remaining canal segments.

**TABLE 6-1: RECOMMENDED PLAN FEATURES**

<b>C-111 SC Western Project: Recommended Plan, Alternative 2DS</b>	<b>Plan Features</b>
	1. 590 Acre Frog Pond Detention Area (FPDA) with a maximum pool depth of 3 feet – includes pump to intercept available water
	2. Pump Upstream of S-177 to discharge into the Aerojet Canal and Connector canal between the pump and Aerojet Canal
	3. One new operable structure in the lower C-111 Canal
	4. Incremental operational changes at S-18C
	5. One plug at S-20A
	6. Operational changes at S-20
	7. 10 plugs in the C-110 Canal
	8. Recreational Components
	9. Project Monitoring Plan
	10. Draft Project Operating Manual
	11. OMRR&R

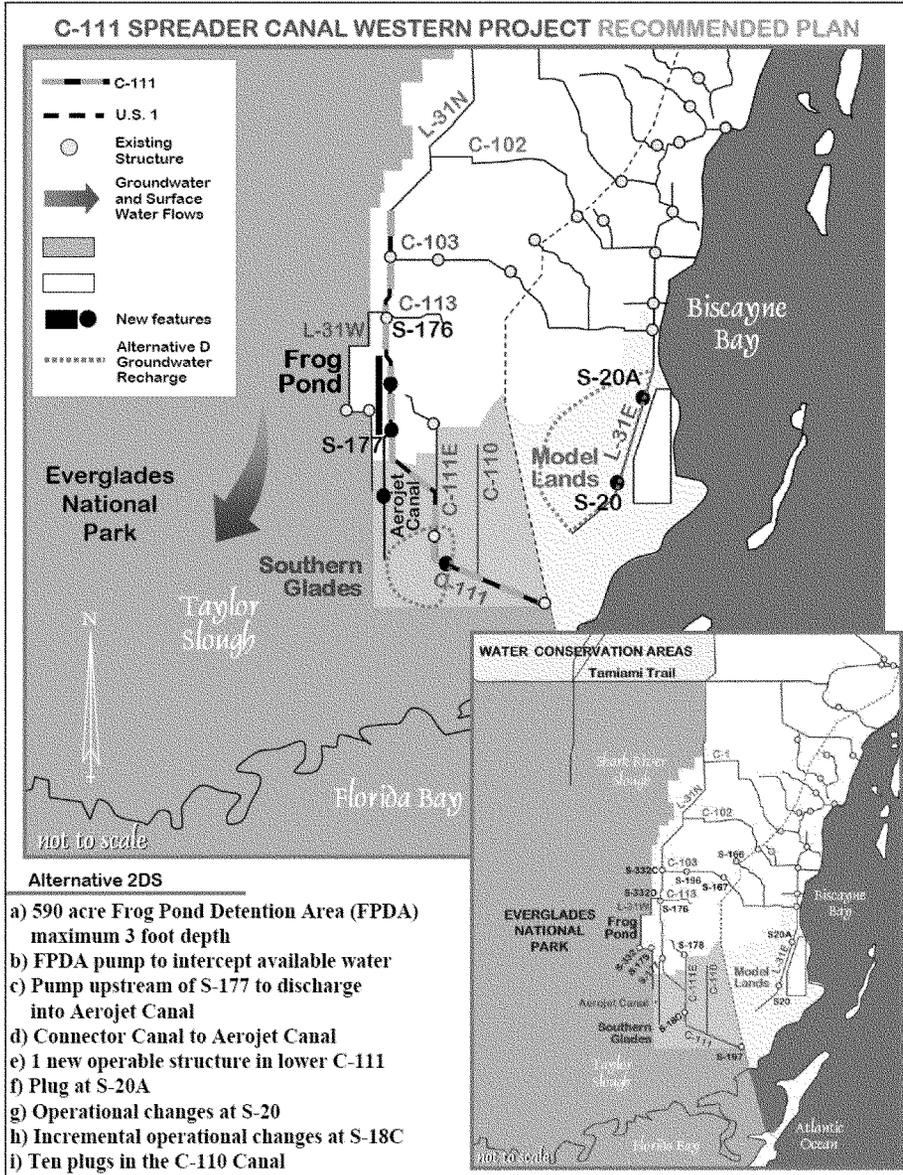


FIGURE 6-1: THE RECOMMENDED PLAN

\*Note: Only restoration features included on map. Secondary elements such as Project Monitoring Plan and OMRR&R not included.

## 6.2 PROJECT MONITORING PLAN

A Project Monitoring Plan (PMP) was developed for the proposed project in order to ensure proper operation and performance of the project, observe ecological changes in response to plan implementation, and ensure compliance with necessary water quality monitoring regulatory requirements. Implementation of the C-111 SC Western project and subsequent learning opportunities will require a more intensive PMP than is typically produced for CERP projects. The typical CERP project monitoring plan only encompasses activities that are not covered under the RECOVER Monitoring and Assessment Plan (MAP). As such, these typical plans are only useful on a system-wide basis. The PMP for the C-111 SC Western project will be devised to concentrate on project-specific adjustments that will optimize both the Recommended Plan and create the desired situations for learning opportunities to fully maximize environmental benefits for the future C-111 SC Eastern project. Part I of the PMP, the Hydrometeorological Section, mainly deals with operational monitoring and will measure such elements as surface and groundwater levels and flows. The second part of the PMP is the Water Quality and Regulatory Compliance Section. This section will fulfill the requirements necessary under current environmental laws and regulations. Part III of the PMP is the Ecological Monitoring Section. This part of the PMP will serve as a tool to assist in evaluating project performance and also to help facilitate scientific-based decisions that are made during adaptive management of the proposed project. The PMP has been reviewed by the Quality Assurance Oversight Team and is in compliance with Quality Assurance System Requirements (QASR) for quality assurance protocols of data collections and analyses. The total estimated cost for the Project Monitoring Plan is estimated at \$4,316,665. Construction general funds will fund \$3,140,631 during construction and the operational testing and monitoring period. The remaining balance, \$1,176,034 will be an O&M cost of approximately \$50,000 annually. Endangered species monitoring costs, to meet the terms and conditions contained in the Biological Opinion, are \$1,394,837 during the construction period and the remaining balance, \$903,393, will be an O&M cost of approximately \$35,000 annually. Detailed breakouts of the costs are located in *Annex E*.

## 6.3 NUISANCE AND EXOTIC VEGETATION CONTROL PLAN

In addition to the Project Level Monitoring Plan, a nuisance and exotic vegetation control plan has been developed in conjunction with USACE policy. This policy compliments the National Invasive Species Act and strives to either prevent or reduce establishment of invasive and non-native species at project sites. The primary objectives of this effort for the C-111 SC project is to establish favorable conditions suitable for the long-term maintenance control of non-native species, and the re-establishment of native flora. To

achieve these goals, this plan proposes to complete both initial and long-term invasive plant control efforts necessary to achieve maintenance control levels of invasive vegetation within the project area.

Recognizing that anticipated costs could escalate or be reduced due to unanticipated spread of exotic and/or nuisance species, increased labor costs, or an increase chemical applications; it is estimated that the initial control effort will take six years at a total cost of approximately \$6,208,400. Annual maintenance after the first six years will costs an estimated \$350,000 annually. During the construction and operational testing and monitoring period the vegetation management will be funded with construction funds in the amount of \$3,104,200. The remaining balance, \$4,504,200, will be an O&M cost with an approximate annual cost of \$182,000. Specifics of the nuisance and exotic vegetation control plan are contained in Annex E, part IV.

#### 6.4 DRAFT PROJECT OPERATING MANUAL

A Draft Project Operating Manual (DPOM) was developed to control day-to-day water management functions of the C-111 Spreader Canal Western project. The DPOM encompasses all foreseeable conditions that may be encountered during project operation. The project will be operated in accordance with the DPOM to achieve the goals, purposes, and benefits outlined in the Project Implementation Report (PIR), including the improvement of the quantity, timing, and distribution of water in the natural system. All costs associated with the physical operation of the project will be funded through O&M.

It is important to note that the project is currently in the PIR/Environmental Impact Statement (EIS) Phase, and there is a high probability that modifications and/or revisions to the Project Operating Manual (POM) will occur during subsequent project phases. Report preparation is pursuant to Engineering Regulation (ER) 1110-2-240, and is in accordance with guidance contained in Engineering Manual (EM) 1110-2-3600, ER 1110 2 8156, and the Programmatic Regulations Guidance Manual Number 5.

#### 6.5 RECREATION COMPONENTS

The C-111 SC Western project recreation plan consists of a trailhead with parking, traffic controls, a shade shelter with interpretive board, and approximately 6.8 miles of designated multi-use levee trails atop impoundment cell levees. Environmental restoration-compatible recreation use would include: hiking, biking, bank fishing, nature study, bird watching, FWC managed hunts and equestrian use. The proposed recreation plan would help to fill existing and projected SCORP 2000 recreation deficits for

Region 11 and satisfy public needs heard during CERP Master Recreation Plan Outreach Meetings in 2006 and 2008. Recreation is proposed on project fee lands. No additional land costs are required for the proposed recreation. Total first cost for the recreation plan is estimated to be \$203,000.

*FIGURE 6-2* provides a plan view of the proposed recreational components. The "corners to be filled for future use" indicate areas that would be constructed in order to facilitate the ease of vehicular access to the levees. These areas will also allow space for hikers, birdwatchers, and other recreational users to safely pass maintenance vehicles when present on the levee crown.

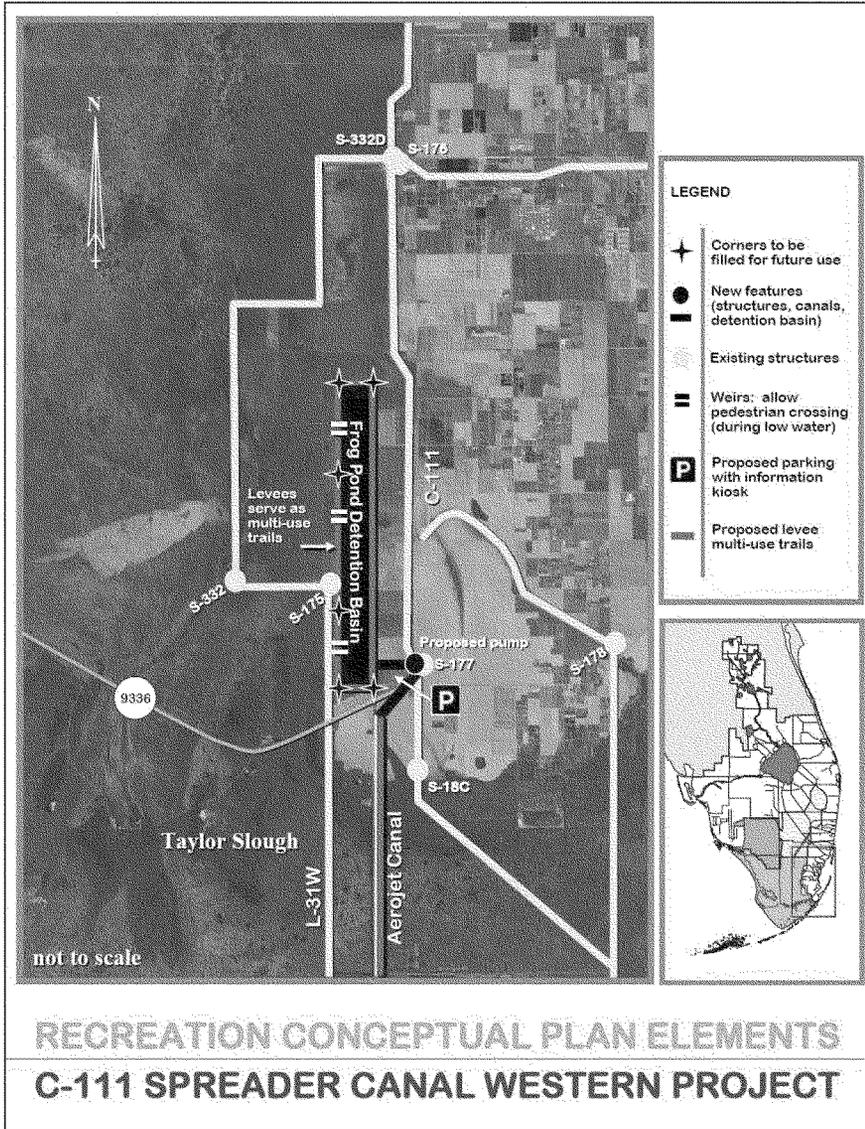


FIGURE 6-2: RECREATION CONCEPTUAL PLAN ELEMENTS

**TABLE 6-2: SUMMARY OF RECREATION COSTS AND BENEFITS**

<b>Recreation Construction Costs</b>	<b>\$213,000</b>
PED & S/A (20%)	\$43,000
<b>Total Recreation Construction</b>	<b>\$256,000</b>
Construction Duration	12 months
Interest During Construction Costs	\$10,000
<b>Total Recreation Investment</b>	<b>\$266,000</b>
Period of Analysis	40 years
Annualized Cost	\$20,000
OMRR&R	\$25,000
<b>Average Annual Cost</b>	<b>\$45,000</b>
<b>Annual Benefits</b>	
User Day Value	\$7.27
Daily Use	46
Annual Use	16,425
<b>Average Annual Benefit</b>	<b>\$122,000</b>

Note: The benefit to cost ratio is 2.7. Net annual benefits are approximately \$77,000. Appendix H provides a more detailed description of the recreation plan along with the associated benefits and costs. Recreation Benefits reflect 2009 unit day values from EGM, 09-02

**TABLE 6-3: SENSITIVITY ANALYSIS USING MULTIPLE SCENARIOS**

<b>Scenario</b>	<b>Annual Users</b>	<b>Daily Users</b>	<b>Annual Benefit</b>
Most Likely	16,425	46	\$86,000.00
Worst Case	5,110	15	\$39,803.00
SCORP Guidelines	19,412,730	53,185	\$141,129,056.00

Note: A sensitivity analysis was performed to check expected benefits and provide additional justification for proposed recreation features. SCORP expected benefits are provided for comparison with the proposed C-111 SC Western project recreation benefits. This economic analysis suggests there would be ample benefits to conservatively justify the proposed recreation facility construction for the C-111 SC Western project.

## 6.6 COST ESTIMATE

A breakdown of the cost of the C-111 SC Western project including construction, lands and damages, ecosystem restoration elements, Pre-Construction Engineering and Design (PED) costs, recreation and interest during construction is included in *TABLE 6-4*. The total estimated project first cost is \$161,044,000. Project costs were estimated at FY '11 price levels and rounded to the nearest \$1,000. Average annual costs were calculated using the currently prescribed federal discount rate of 4.125% and a 40 year period of analysis.

**TABLE 6-4: PROJECT COSTS FOR THE RECOMMENDED PLAN**  
(FY '11 Price Level)

(Initial cost rounded to the nearest \$1,000)

<b>Construction Item</b>	<b>Cost</b>
Lands & Damages	67,682,000
Elements	
08 Roads, Railroads, and Bridges	244,000
09 Channels & Canals	46,050,000
13 Pumping Plant	14,458,000
15 Floodwall Control Diversion Structure	5,301,000
14 Recreation Facilities	256,000
<b>Sub-Total</b>	<b>\$133,991,000</b>
Planning, Engineering, and Design (PED, E&D)***	19,562,000
Construction Management (S&A)	7,491,000
<b>Total First Cost</b>	<b>\$161,044,000</b>
Investment Costs	
Interest During Construction	
--Construction	3,550,000
--Real Estate	5,950,000
<b>Total Investment Cost</b>	<b>\$170,544,000</b>
Average Annual Costs	
Interest and Amortization of Initial Investment	8,780,000
OMRR&R****	1,493,000
<b>Total Average Annual Costs</b>	<b>\$10,273,000</b>

\*The costs shown above are updated, detailed costs that are not equivalent to the preliminary, planning-level cost estimates utilized for the alternative comparison in Section 5 and the Economic Appendix. Costs for the Project Monitoring Plan were not included in the total project costs in accordance with current cost estimating practices.

\*\* Recreation costs detailed in table 6-4 are greater than described in section 6.5 and the recreation appendix because costs have been escalated to FY11 price levels.

\*\*\* PED costs do not include the sunk PIR costs of \$1,080,000.

\*\*\*\* OMRR&R Costs include \$267,000 for hydrometeorological, ecological, water quality, endangered species, and vegetation management monitoring costs that occur after construction and operational testing and monitoring is complete, but not for longer than 10 years.

**TABLE 6-5** includes a comparison of Yellow Book, project first cost and fully funded estimate in FY '11 price levels.

TABLE 6-5: COMPARISON OF YELLOW BOOK AND THE RECOMMENDED PLAN FIRST COST FOR THE C-111 SC WESTERN PROJECT (FY 11 PRICE LEVEL)\*

Yellow Book	Project First Cost	Fully Funded Cost
\$94,034,000	\$162,124,000 (Includes Recreation Cost)	\$173,676,000

\* Includes sunk PED costs

Based on the engineering and design of the Recommended Plan for this study, the average annual cost for Alternative 2D Short, is \$10,333,000.

The Recommended Plan will result in total average annual habitat units (HUs) of 8,271 per year. The average annual cost, minus the recreation O&M and construction features, is \$10,228,000 leading to an average annual cost per average annual HU of \$1,236.

## 6.7 MCACES COST ESTIMATE

### 6.7.1 STATUS OF THE MCACES COST ESTIMATE

An MCACES/MII cost estimate (following) has been prepared for the Recommended Plan and is formatted in the Civil Works Breakdown Structure (CWBS). It includes both construction and non-construction costs. Extensive details on the cost estimating for this project are found in *APPENDIX B, Cost Estimates*. The following paragraphs are intended to provide a brief overview of the estimate.

#### 6.7.2 Construction Costs

Construction cost estimates for the Recommended Plan are prepared based on calculated quantities and unit prices that are commensurate with the degree of detail of the design. At the most detailed level, each task is preferably related to and performed by a crew. Notes are included in the estimate to clarify the design, cost, crew, productivity and unit price assumptions. Some of the tasks are taken from the USACE 'Cost Book', and others are created by the cost engineer, to depict costs in the preferred labor, equipment, material, crew and productivity format. Cost Book tasks may be modified to incorporate quotes from vendors that more accurately reflect local costs at the project site. Hourly equipment rates are obtained from the appropriate regional pamphlet, Region III of Engineer Pamphlet (EP) 1110-1-8, Construction Equipment Ownership and Operating Expense Schedule, or are developed according to the methodology as described in that

pamphlet. Labor rates are either current Davis-Bacon rates or Bureau of Labor Statistics area-specific rates.

Markups are added to the costs outlined above to account for a prime contractor and subcontractors, allowing profit (determined using the weighted profit guidelines), job office overhead, home office overhead and bond. Contingency is also added to account for unknowns.

### 6.7.3 On-Site Soil Considerations

As described in *Section 2.7*, the majority of the surficial soils within the project construction footprint have been classified as several types of Biscayne Marl. These soils, which are underlain by limestone bedrock (cap-rock), are generally 6 to 8 inches deep and are unsuitable for constructing the project's planned components. As a result, the surficial marl soils cannot be used for levee construction unless thoroughly mixed with more structurally sound soils.

Removal of the surficial soils from areas to be re-hydrated has also proven to be a highly effective method of preventing the colonization and spread of invasive and/or exotic vegetation (please see Annex E Part IV, Vegetation Management Plan). Removal by loaders, and other similar motorized equipment, has been demonstrated to remove enough substrate to inhibit plant colonization, and was incorporated into the designs of the CS&F C-111 project (S-332B, C, and D Flowways), the MODWATERS project (S-357 Stormwater Treatment Area), and the Everglades National Park "Hole-in-the-Donut" project.

As such, the project design calls for removing surficial soils within the project footprint to the top of the limestone cap rock. SFWMD has indicated that its contractor will mix the excavated material with structurally sound soils for construction suitability and then utilize the mixed material in the construction of the core of the perimeter levees and berms. Excess material will be permanently placed in designated areas outside the proposed levees, compacted in two-foot lifts, and grassed to protect against erosion. Treatment of the soils containing residual agrochemicals will be a 100% Non-Federal Sponsor cost. In accordance with an ASA (CW) letter issued on June 4, 2010, any proposed treatment of soils containing agricultural chemicals that are above a risk level (including an ecological risk level) and will remain on the project lands must comply with the 5 conditions outlined in the letter. The Corps has determined that the current proposal to treat the soils containing agricultural chemicals on project lands is consistent with the five criteria as follows:

- 1) The non-Federal sponsor (NFS) provides 100% of the costs for handling and treating the agricultural chemicals. The NFS's costs for items that are

part of normal engineering and construction activities are not considered treatment of agricultural chemicals. These normal engineering and construction activities must be the same activities required to construct the project features absent the presence of agricultural chemicals in the soil. Such normal engineering and construction activities will remain a part of total project cost even if the actions coincidentally result in the concentration of agricultural chemicals in the soils being below any risk level.

2) There is adequate documentation of regulatory approval of the proposed treatment. Documentation of the appropriate regulatory approvals is being obtained by SFWMD and will be provided prior to execution of the PPA. Jacksonville District, SFWMD, FDEP and USFWS have all concurred with the methods, protocols, and recommended action plan described in the soil management plan.

3) The use of project lands is determined to be a cost effective option. Utilization of the onsite soils for construction material will represent an actual cost savings over typical construction methods, as soil is typically imported from offsite for levee construction. Additionally, no offsite disposal costs will be incurred as unused soils will be stockpiled onsite, capped and seeded in order to prevent the spread of exotics from any seedbank contained in excess soil. Offsite disposal costs for soils for the Indian River Lagoon South C-44 Project approached \$36 million, demonstrating the magnitude of extreme costs associated with alternative methods. The cost for offsite disposal for this project was estimated to be approximately \$45,000,000. This estimated is based on the excavation of 441,000 cubic yards of material (419,000 from the FPDA, and 22,000 from the Aerojet Canal component area), loading costs, hauling costs, and dumping fees at a landfill. The closest county owned landfill (South Dade Landfill) indicated that they would charge approximately \$70 per ton for disposal though this landfill would not have the capacity to accept all of the material.

Onsite soil management costs have been estimated to be \$254,000 for incorporation into levee construction, and \$206,000 for fine grading and seeding of stockpiled material not utilized in levee or berm construction. The construction methods for the C-111 Spreader Canal Western Project have been reviewed and are supported by all regulatory agencies involved in the project, and would provide a substantial reduction in total project cost when compared to more exhaustive treatment and disposal methodologies. Overall, there is a low amount of risk involved with the proposed project and it would represent an extremely cost effective means of managing onsite soils.

4) The engineering risks are determined to be adequately addressed. The USACE and SFWMD both have extensive credibility in the design,

construction and operation and maintenance of the proposed project features as a result of previous water resource planning efforts. Standard engineering and construction practices will be employed for the proposed project and no new technologies will be utilized. Overall, the likelihood of improper construction, levee damage, or faulty operation and/or maintenance is low. Additionally, an exhaustive monitoring plan has been developed for the proposed project in order to ensure that the project performs as expected. The proposed project and soil management plan has been coordinated with the FDEP and USFWS and concurrence on the engineering methods has been received. As such, the engineering risks associated with the soil management for the proposed project is considered to be low and sufficient to protect human health and the environment.

5) SFWMD agrees to an adequate indemnification agreement. SFWMD will be conducting all handling and treatment of soil containing agricultural chemicals. Because SFWMD is conducting the handling and treatment, this requirement will be fulfilled with the execution of a Project Partnership Agreement that incorporates Article X (Indemnification) of the Master Agreement between the Department of the Army and South Florida Water Management District for Cooperation in Constructing and Operating, Maintaining, Repairing, Replacing, and Rehabilitating projects authorized to be undertaken pursuant to the Comprehensive Everglades Restoration Plan executed on August 13, 2009.

The removal of existing surficial soils is integral to the design of the project as a cost-effective measure to permanently reduce or eliminate exotic and nuisance vegetation and as a means to provide a stable subgrade for support of the proposed levees and structures.

#### 6.7.4 Non-Construction Costs

Real estate costs were provided by the Real Estate Division. These costs are best described in the Real Estate Appendix. They include lands costs and administrative costs and are distinguished as non-federal sponsor costs. Contingency is applied to these costs at the rate of 25 percent. Planning, engineering and design costs are twelve percent of the total construction cost, as is customary for this level of estimating in USACE, Jacksonville District's Cost Branch. This percentage can roughly be broken down into ten percent of construction costs for Planning, Engineering and Design, and two percent for EDC. Construction management costs are eight percent of the total construction cost, as is customary for this level of estimating in USACE, Jacksonville District's Cost Branch.

The MCACES/MII cost estimate on the Recommended Plan will be refined as the design of the plan is refined. At the same time, the risk analysis will be refined.

#### 6.7.5 MCACES/MII Printout

The MCACES/MII printout is located in *APPENDIX B- COST ESTIMATES* of this document.

### 6.8 DESIGN AND CONSTRUCTION CONSIDERATIONS

#### 6.8.1 Engineering and Design

Planning engineering and design activities would be accomplished in accordance with USACE and SFWMD requirements. Preliminary design activities, which included survey and geotechnical investigations as well as cultural resources compliance, commenced in early 2004. The SFWMD prepared a Basis of Design Report (BODR) under its Expedited Construction program. The BODR includes all engineering assumptions and conceptual designs for each of the project features. After review of the BODR by the USACE, the SFWMD prepared initial plans and specifications for construction contract award (30% design). All design work has been coordinated and reviewed with the USACE to meet USACE standards and regulations. The intermediate plans and specifications for construction contract award are set to be completed in late March 2009.

The Recommended Plan, Alternative 2DS, is identical to the State's Expedited Construction program features.

#### 6.8.2 Construction and Implementation of the Plan

The SFWMD is exploring alternative project delivery methods to expedite implementation of the project through its Expedited Construction program.

#### 6.8.3 Detention Area Physical Characteristics

The two detention areas, the Frog Pond Detention Area and the Aerojet, will not function or be managed as habitat. The function of the detention areas is solely for water detention and infiltration to form a hydraulic ridge. As water will not be retained in the detention areas, it is unlikely that they will be utilized by native species in the area for foraging or breeding. Any colonization by exotic species will be managed as part of normal operation in the detention areas.

Although some nutrient removal may occur as a result of the temporary retention of water, the detention areas were not designed to function as

stormwater treatment areas. Water quality in the C-111 Canal in this area meets current standards. There may be some minimal growth of cattails as a result of westward seepage of water out of the detention areas. Any possible growth of cattails in this area is expected to be minimal, and should be limited to the immediate western edges of the detention areas.

## 6.9 LANDS, EASEMENTS, RIGHTS OF WAY, AND RELOCATIONS CONSIDERATIONS

USACE policy and Section 601 of the WRDA 2000 requires that the non-federal sponsor obtain and provide certification of all lands, easements, rights-of-way, and relocations (LERRs) necessary for project implementation prior to advertisement for construction.

### 6.9.1 Real Estate Requirements

The lands required for the Recommended Plan are based on an analysis of the lands needed for construction, and operation, maintenance, repair, replacement and rehabilitation (OMRR&R) of the project. The real estate component of the Recommended Plan is tentative in nature and intended for planning purposes only. Total estimated cost of real estate is \$67,682,000. Both the final real property acquisition lines and the real estate cost estimates provided herein and in *APPENDIX D* are subject to change. The real estate requirements for the Recommended Plan are discussed in greater detail in *APPENDIX D*.

### 6.9.2 Land Acquisition

Within the C-111 SC Western project, which is comprised of approximately 12,176 acres, approximately 590 acres within the Frog Pond are of the C-111 South Dade project and will be provided as an item of local cooperation under that project. Approximately 0.5 of an acre is within the right of way of the L31E canal and approximately 2 acres are within the right of way of the Lower C-111 Canal both of which are part of the Central & Southern Florida Project and will be provided under that project. The SFWMD will not receive credit for these lands under the C-111 SC Western project. For those lands within the Aerojet area, approximately 18 acres are required in fee and are owned by the SFWMD.

The planning level modeling which was completed for purposes of cost estimating indicated that approximately 11,565 acres were determined to be impacted by the operation of the project. SFWMD owns fee to approximately 9,688 acres which will be provided in fee. Miami-Dade County owns approximately 131 acres in fee which will be provided by SFWMD by supplemental agreement with Miami-Dade County as further explained

below. The State of Florida owns approximately 15 acres that will be provided by SFWMD by supplemental agreement with the State of Florida as further explained below. In accordance with the terms of the MASTER AGREEMENT BETWEEN THE DEPARTMENT OF THE ARMY AND SOUTH FLORIDA WATER MANAGEMENT DISTRICT FOR COOPERATION IN CONSTRUCTING AND OPERATING, MAINTAINING, REPAIRING, REPLACING AND REHABILITATING AUTHORIZED PROJECTS UNDER THE COMPREHENSIVE EVERGLADES RESTORATION PLAN, the SFWMD may enter into supplemental agreements with the State of Florida and/or Miami-Dade County, whereby (1) the State of Florida or Miami-Dade County, will dedicate the land interests it owns and ensure that lands, easements and rights-of-way are retained in public ownership for uses compatible with the purposes of the Western C-111 Spreader project and (2) the land interests shall not be conveyed, transferred, altered or otherwise encumbered without the advance written consent of the NFS and Government. These supplemental agreements shall be limited in effect to the signatory parties and shall not reduce or alter in any way the requirements of this Master Agreement and any PPA which makes the non-Federal sponsor solely responsible for providing all lands, easements, and rights-of-way. Florida Power and Light Company (FP&L) owns approximately 955 acres that will be provided by perpetual flowage easements. The planning level modeling predicted approximately 776 remaining acres which are owned by private parties could be impacted by the operation of the project. SFWMD has agreed to acquire in fee privately owned lands which are jointly determined to be impacted or jointly determined to have been impacted by operation of the project. **TABLE 6-6** indicates acreage needed for the Recommended Plan.

**TABLE 6-6: OWNERSHIP OF PROJECT RELATED LANDS AND REAL ESTATE INSTRUMENTS**

<b>Location</b>	<b>Component</b>	<b>ACRES</b>
<b>Frog Pond Area-SFWMD owned</b>	Frog Pond Detention Area (FPDA)	560
<b>See Note 1 Below</b>	Pump for FPDA (diesel)	0.5
	Pump for FPDA (electric)	0.5
	Berm for FPDA	22.84
	Canal from Pump to FPDA	6.54
<b>Aerojet Area-SFWMD owned</b>	Pump for Aerojet Canal on C-111 (diesel)	0.5
<b>See Note 2 Below</b>	Pump for Aerojet Canal on C-111 (electric)	0.5
	Canal from Spillway to Aerojet Canal	6.2
	Berm for Aerojet Canal	11.16
<b>Lower C-111-SFWMD owned</b>	Water Control Structure (mimic S-197)	1
<b>See Note 3 Below</b>	Second Water Control Structure (mimic S-197)	1
	Plug in L-31E at S-25A	0.5
<b>OTHER:</b>	<b>Impacted Lands</b>	
SFWMD Owned		9,688
Miami-Dade County		131
State of Florida		15
Florida Power & Light		955
Private Owners*		776
	<b>Project Footprint Proposed (rounded up)</b>	<b>12,176</b>

Note 1 Lands in Frog Pond area are within the C-111 South Dade Project

Note 2 Lands in the Aerojet area required for these structures are within the Impacted Lands

Note 3 Lands in the Lower C-111 are within the right of way of the C&SF Project

(\*The planning level modeling predicted approximately 776 remaining acres which are owned by private parties could be impacted by the operation of the project. SFWMD has agreed to acquire in fee privately owned lands which are jointly determined to be impacted or jointly determined to have been impacted by operation of the project.

### 6.9.3 Relocation Assistance

In accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended (Public Law [PL] 91-646), relocation assistance must be provided to affected residents and businesses. Information provided by the SFWMD would indicate that relocation assistance is not required. Upon certification of the LERR, the SFWMD would be required to demonstrate compliance with the requirements of PL 91-646 including that landowners have been properly advised of their rights under the program and that which evidence appropriate benefit determinations. To include:

- Number of persons, farms and businesses displaced
- Estimate of all PL 91-646, Title II costs and contingencies
- Discuss/describe availability of replacement housing and any need for last resort housing benefits

Based on current information, it appears that there are no relocation assistance payments to be made or that will be required.

### 6.10 OPERATIONS AND MAINTENANCE CONSIDERATIONS

Annual operation and maintenance costs were estimated for the construction features of the Recommended Plan. The operation and maintenance costs were determined by extrapolation from operational costs histories supplied by South Florida Water Management District (SFWMD), using industry standard cost data and by using data from past and projected future cost trends. Replacement costs were calculated based on current cost plus anticipated inflation, and included at manufacturer recommended intervals. The annual OMRR&R costs for the first year of operation are estimated, based on preliminary data, to be \$1,201,000 (rounded). Annual O&M costs for recreation are estimated at \$25,000 for trash pick-up and recreation facility repair, rehabilitation and replacement. Annual O&M costs for project monitoring and vegetation management are estimated at \$267,000 annually. Project monitoring includes hydrometeorological monitoring, ecological monitoring, water quality monitoring, endangered species monitoring. Vegetation management is the management and control of exotic and nuisance vegetation.

### 6.11 ADAPTIVE MANAGEMENT

The Incremental Operational Changes at S-18C are the main adaptive management feature for the proposed project. Section D.22 of the Draft Project Operating Manual (DPOM) contains a detailed description and methodology for increasing the operational triggers at S-18C and assessing

the resulting changes in hydroperiod. The operations of this feature will be monitored with the data being utilized to prevent flooding in private lands while maximizing ecosystem restoration.

The Frog Pond Detention Area and Aerojet Canal will be initially operated in accordance with the DPOM. These project features can also be adaptively managed by the SFWMD in order to optimize ecosystem restoration in ENP and project performance. A highly detailed adaptive management plan was not prepared for these two features as the operational flexibility is minor when compared to the Incremental Operational Changes at S-18C. The new operable plug in the lower C-111 will also be adaptively managed for maximum ecological output; however, due to the remote location and distance from any privately-owned lands, there is a negligible chance and flooding occurring. As such, no detailed adaptive management plan was developed for this feature.

The remaining features of the proposed plan such as the ten plugs in the C-110 Canal and plug at S-20-A will not be adaptively managed as these are permanent, non-flexible structures. The uncertainty of the restoration potential of these features was extremely low and therefore these features do not require any manipulation once constructed. The effectiveness of these features will be used to guide further restoration in the future Eastern PIR.

#### 6.12 PLAN ACCOMPLISHMENTS

Taylor Slough is a deepwater flow way that is instrumental in delivering water to the mangrove wetlands and southern estuaries of Everglades National Park. The ability of Taylor Slough to retain the natural inflows and rainfall is imperative to maintaining the ecological health of the natural system. The Recommended Plan will provide a means to secure the hydrological inputs to Taylor Slough and prevent seepage from being lost to the C-111 Canal. The plan will promote the restoration of vegetative communities and fish and wildlife habitat that is currently deteriorating within Taylor Slough and its tributaries.

The Recommended Plan will also offer a jump-start for impending restoration through the Eastern PIR as well as provide the means to evaluate Decision Critical Uncertainties to optimize forthcoming restoration plans. Impediments to flow will be constructed in existing canals that currently serve to drain the wetlands of the southeastern portion of the Everglades. While raising hydroperiods and restoring hydropatterns in the project area, the plugs and other structures will provide valuable information through monitoring that will be utilized to guide further elimination of drainage canals in the Eastern PIR. Additionally, information gleaned from the

monitoring will provide modelers with a basis for evaluating effects of the future spreader canal.

The Recommended Plan is consistent with the CERP Goals and Objectives. The Plan would enhance ecological values by increasing the spatial extent of natural areas, improving habitat function and quality, and also improving native plant and animal species abundance and diversity. Additionally, the Plan would enhance economic values and social well being. Increases in recreational opportunities would occur in the study area of south Florida as a result of the project. There would also be increased employment opportunities and a strengthening of the local economy as a consequence of project construction. The proposed project would not decrease the availability of fresh water for agricultural, municipal, or industrial use, nor would the project reduce flood damage reduction across the area. There would be no impact to historical, cultural, or archaeological resources as a result of project implementation.

#### 6.13 NEXT ADDED INCREMENT ANALYSIS

The C-111 SC Western project is located at the terminus of the Everglades and south Florida regional water system. The proposed C-111 SC Western project does not contribute water to any other CERP projects and is not responsible for any municipal water supply deliveries; therefore, the proposed project does not influence the planning design or operational criteria of any upstream features. In other words, the C-111 SC Western project is the receiving body of CERP flows, as well as assumed future without project condition flows and has been evaluated and compared as such.

The CERP Programmatic Regulations require evaluation of the TSP as the next added increment (NAI). The NAI is defined in the CERP Programmatic Regulations as “the next project to be added to a system of projects that includes only those projects that have been approved according to general provision of law or specific authorization of Congress and likely to be implemented by the time the project being evaluated is completed.” The NAI analysis evaluates the effects, or outputs, of the Recommended Plan as the next project to be added to the group of already approved CERP projects. This analysis illustrates the amount of benefits the selected alternative plan contributes without regard to future CERP projects. It also helps to ascertain whether sufficient benefits would accrue to the selected alternative plan to justify the cost if no additional CERP projects (other than those already existing or authorized) were implemented. In the case of this analysis, no other CERP projects affecting the C-111 SC Western project area were assumed to exist for the purposes of the NAI analysis.

In comparing SFWMM model flows from the future without and all of CERP at S-177 (critical structure used to determine flows to the spreader canal), the flows are similar. This means that whether or not CERP boundary conditions (system evaluation) or future without boundary conditions are used, similar results should be obtained in the overall evaluation and comparison of alternatives. Thus, in the essence of expediting the AFB process, all plan comparison and evaluation was completed in a NAI method. This approach was discussed and approved in the summer of 2007 via submission of a formulation strategy paper and subsequent IPR with USACE HQ and SAD.

#### 6.14 IMPLICATIONS TO CENTRAL AND SOUTHERN FLORIDA SYSTEM OPERATION

It is not anticipated that any disruptions to the existing C&SF project features and operations will be required as a result of project implementation. The proposed project is situated at the terminus of the C&SF project system, and there are no structures or operational criteria that would be dependent on the project for water contributions. As such, no impacts to any regulation schedules of Lake Okeechobee nor WCAs are expected. The project team has determined that there would be no effect on the C&SF system ability to reduce flood damages in the project area. Additionally, no reduction in the level of service for water supply to meet municipal, industrial, and agricultural demands should occur.

#### 6.15 ENVIRONMENTAL OPERATING PRINCIPLES

The Recommended Plan is consistent with each of the USACE Environmental Operating Principles. The following paragraphs elaborate on the balanced and comprehensive approach that was undertaken by the USACE and its partner to develop a responsible and accountable solution for environmental recovery of the Nation's natural resources.

**Principle One:** Strive to achieve environmental sustainability. An environment maintained in a healthy, diverse condition is necessary to support life.

Natural resource specialists agree that the remaining ecosystems in south Florida no longer maintain the functions and richness that defined the pre-drainage system. These measures of ecological health will continue to decline without preventative actions. Not only is it certain that these natural systems will not recover their defining attributes under current conditions, it is unlikely that the current, degraded ecological conditions can be sustained in the future.

The C-111 Western Spreader Canal project is one of many different projects that work in unison to provide environmental restoration as part of the CERP. Congress approved the CERP as the “framework for modifications and operational changes to the C&SF project that are needed to restore, preserve, and protect the south Florida ecosystem while providing for other water-related needs of the region, including water supply and flood protection (WRDA, 2000). As such, the primary purpose of the CERP is the restoration of the Everglades ecosystem, including specific safeguards to ensure that the benefits to the natural system are achieved and maintained, while providing for other water-related needs of the south Florida region.

**Principle Two:** Recognize the interdependence of life and the physical environment. Proactively consider environmental consequences of USACE programs and act accordingly in all appropriate circumstances.

The proposed C-111 Western Spreader Canal project would provide immediate benefits to Everglades National Park and the southeast Florida ecosystem. Rainwater and natural hydrologic inflows in Taylor Slough would remain in the system, providing for improvements in habitat function. Hydroperiods and hydropatterns would be restored in parts of the Model Land and Southern Glades, providing an ecological “jump start” for future restoration efforts. Overall, there would be no cumulative, negative environmental consequences as a result of the C-111 Western Spreader Canal project.

**Principle Three:** Seek balance and synergy among human development activities and natural systems by designing economic and environmental solutions that support and reinforce one another.

The C-111 Western Spreader Canal project will provide beneficial effects in the natural system while also ensuring that no impacts occur to residential and agricultural areas. The proposed project would provide additional resources for the human environment through improved recreation opportunities. The C-111 Western Spreader Canal project will have no negative effect on water resources for urban utilities or flood damage reduction within this area of south Florida.

**Principle Four:** Continue to accept corporate responsibility and accountability under the law for activities and decisions under our control that impact human health and welfare and the continued viability of natural systems.

The C-111 Western Spreader Canal PIR complies with all applicable law such as the NEPA, Clean Water Act, Endangered Species Act, and any other

applicable legislation. The proposed project would produce both National Economic Development Benefits and National Ecosystem Restoration Benefits. Ecological values will be enhanced and as well as economic values and social well-being. The C-111 Western Spreader Canal project will increase the spatial extent of natural areas, improve habitat and functional quality, and improve native plant and animal abundance and diversity. These improvements will occur through the restoration of hydroperiods and hydropatterns in the natural system. Improving fish and wildlife habitat as a result of project implementation should enhance recreational opportunities across the proposed project area. Additionally, recreational opportunities will be provided on public lands.

**Principle Five:** Seek ways and means to assess and mitigate cumulative impacts to the environment; bring systems approaches to the full life cycle of our processes and work.

The USACE takes a watershed approach for all Ecosystem Restoration initiatives. Rather than focusing on one specific area, all projects are examined in order to determine the effects within the entire affected natural system. By doing this, the USACE is able to avoid and minimize any potential project impacts that may occur as a result of the implementation of any project. Foreseeable impacts have been assessed as part of the PIR process and considered in the plan selection. Management measures have been proposed to follow throughout construction to limit or avoid any negative impacts. In addition, a system wide monitoring plan of the natural environment will be in place to continue to assess all impacts, and along with adaptive management of the project and other CERP components, will maximize benefits to the system while identifying and limiting any negative effects.

**Principle Six:** Build and share an integrated scientific, economic, and social knowledge base that supports a greater understanding of the environment and impacts of our work.

As part of the Adaptive Management strategy for the CERP, RECOVER teams meet regularly to discuss ways to improve the overall effects of the CERP program. These three teams collectively are composed of many individuals with separate disciplines in order to integrate their specific knowledge of science, economics, and sociology. The teams evaluate the different environmental effects that are expected to occur as a result of CERP implementation, and also assess possible impacts to any areas that can be beneficially adjusted through adaptive management. RECOVER reviewed the proposed C-111 Western Spreader Canal PIR as it was being developed

and provided input as to how the project could best be implemented and operated.

**Principle Seven:** Respect the views of individuals and groups interested in USACE activities, listen to them actively, and learn from their perspective in the search to find innovative win-win solutions to the nation's problems that also protect and enhance the environment.

As part of the NEPA process, the USACE sent out a scoping notice to provide information to the public and/or other agencies in order to encourage participation and receive commentary about the proposed project. Further public input was encouraged through public meetings and stakeholder meetings. The USACE has fully addressed and considered all public commentary concerning the proposed C-111 Western Spreader Canal project.

#### 6.16 CONTRIBUTION TO ACHIEVEMENT OF INTERIM GOALS AND TARGETS

Section 385.39 of the Programmatic Regulations requires the Secretary of the Army and the Governor of Florida to establish interim goals and targets as a means for evaluating progress toward meeting other water-related needs of the region provided by the plan. The interim goals and targets should be utilized in planning projects, interpreting future CERP performance, and guiding the adaptive management process.

The purpose of the CERP interim goals is to provide a means by which the restoration success of the plan may be evaluated at specific intervals of time by agency managers, the State of Florida, and Congress throughout the overall planning and implementation process for the plan. The goals help facilitate adaptive management of the plan, allowing the USACE and non-federal sponsors opportunities to make adjustments to the plan.

A review of the CERP interim goals indicated that the C-111 SC Western project would positively contribute to the following:

##### 6.16.1 Everglades Region

- Water Volume (*Distribute water across the ecosystem in a manner that reflects natural conditions while providing for other water-related needs of the region*);
- Sheetflow (*Establish more historic magnitudes and directions of sheetflow in the natural areas of the Everglades*);
- Hydropattern (*Restore the natural timing and pattern of inundation throughout the ecological communities of south Florida, including sawgrass plains, ridge and slough, and marl marshes*);

- Aquatic Fauna Regional Populations in Everglades Wetlands (*Increase the abundance of fish to levels that approximate those predicted for pre-drainage conditions*); and,
- Flows to ENP (*Provide more natural surface flows to ENP*).

#### 6.16.2 Southern Estuaries Region

- Salinity Patterns in Florida Bay and Biscayne Bay (*Reduce the intensity, duration, frequency, and spatial extent of high salinity events, re-establish flow salinity conditions in mainland nearshore areas, and reduce the frequency of and rapidity of salinity fluctuations resulting from pulse releases of freshwater from canals*); and,
- Freshwater Flows to Florida Bay (*Increase freshwater flows to Florida Bay*).

#### 6.16.3 System-Wide Water Volume

- Quantity of Freshwater Lost to Tide (*Reduce the quantity of freshwater lost to tide*).

A review of project consistency with the CERP interim targets indicates that the proposed project is in agreement with all applicable targets. The following three targets were found to be applicable to the C-111 SC Western project:

- Water Volume (*Distribute water across the ecosystem in a manner that reflects natural conditions while providing for other water-related needs of the region*);
- Flood Control: Root Zone Groundwater Levels in the south Miami-Dade Agricultural Area east of L-31N (*Maintain or improve the level of service of flood protection in accordance with applicable law consistent with the WRDA 2000 and Section 385.37 of the Programmatic Regulations*); and,
- Flood Control: Groundwater Stages for the Miami-Dade, Broward, and Palm Beach counties and Seminole Tribe Surface Water Management Basins (*Maintain or improve the level of service of flood protection in accordance with applicable law consistent with the WRDA 2000 and Section 385.37 of the Programmatic Regulations*).

6.16.4 Project Contribution to Comprehensive Everglades Restoration Plan Goals and Purposes

TABLE 6-7: PROJECT CONTRIBUTION TO COMPREHENSIVE EVERGLADES RESTORATION PLAN GOALS AND PURPOSES

<b>CERP Goal: Enhance Ecological Values</b>
<ul style="list-style-type: none"> <li>• Increase the total spatial extent of natural areas</li> <li>• Improve habitat and functional quality</li> <li>• Improve native plant and animal species abundance and diversity</li> </ul>
<b>CERP Goal: Enhance Economic Values and Social Well Being</b>
<ul style="list-style-type: none"> <li>• Increase availability of fresh water (agricultural/municipal/industrial)</li> <li>• Reduce flood damages (agricultural/urban)</li> <li>• Provide recreational and navigational opportunities</li> <li>• Protect cultural and archaeological resources and values</li> </ul>

The C-111 SC Western project enhances ecological values by improving freshwater flows into Florida Bay via Taylor Slough. A hydraulic ridge would be created in order to retain water in ENP that is currently lost to the C-111 Canal due to seepage. The resulting restoration effects will include the restoration of hydroperiods and hydropatterns in the Everglades. The improvement of habitat and functional quality would occur as the flora and fauna within the natural system respond to the restoration of a more natural hydrologic regime.

Additionally, the restoration of these areas would significantly improve native plant and animal species abundance and diversity. By retaining more water in the natural system, particularly during dry periods, the prey base for a large number of species would strengthen, leading to a population increase and greater opportunities for diversification of the native communities. The restoration of natural hydroperiods would decrease and opportunities for colonization by invasive or exotic species of vegetation. Combined with ongoing projects that work to eliminate nuisance species, a greater abundance of native vegetation and more natural patterns and mosaics should be observed.

The Recommended Plan would also enhance economic values and social well being. Recreational benefits will be produced as a result of the proposed project. Cultural, historical, and archaeological resources in the proposed project area will be protected. There will be no reduction in the availability of freshwater for agricultural, municipal, and industrial purposes nor, will there be any impact to flood damage reduction in the proposed project area.

**SECTION 7  
ENVIRONMENTAL EFFECTS**

## 7.0 ENVIRONMENTAL EFFECTS

This section contains a description of the environmental effects for the final array of alternatives (Alternatives 1D, 2D Short, 2D Long, 3D, and 6D and the No Action Alternative). An even higher level of detail on the environmental effects for the Selected Alternative Plan, based on a higher level of design, can be found in *Section 6 (The Recommended Plan)*.

### 7.1 SUMMARY OF FINAL ARRAY OF ALTERNATIVES

Alternative 1C consists of the Frog Pond Detention Area (FPDA), an approximately 530 acres above ground reservoir to be constructed in Local Sponsor owned lands known as the Frog Pond. In Alternative 1C, the FPDA will be fed, via lined channel, by a 450 cfs pump station to be constructed in line with the northern limit of the FPDA. The western side of the FPDA will consist of an unlined, above ground, header canal. The header canal will include 2 intermediate cascading weirs which will maximize the established hydraulic gradients prior to discharging into one or more of the three eastern reservoir cells. Each of the two intermediate cascading weirs in the header canal will be eighty feet long, and will have a crest elevation approximately 0.5 feet above the adjacent existing ground elevation. Each of the three weirs that discharge (east) to the reservoir cells will also be eighty feet long, but will be constructed with crest elevations. All weirs (3) to the east that deliver water to the three cells will also be eighty feet long, but will have a crest elevation approximately 1.2 feet above the adjacent existing ground elevation.

Alternative 1D will be identical to Alternative 1C, but, like all “D series” alternatives, will include the plug in L-31E Canal (near Structure S-20A), modified S-20 operations, and will include a new “S197-like structure” (which will be designated as S-198).

Alternative 2D Short is identical to Alternative 1D with the exception of a 50% reduction in the FPDA pump station sizing (to 225 cfs), and the creation of a second, “FPDA like” feature within the existing Aerojet Road Canal. The Aerojet Canal feature will be created by extending the existing canal north towards Ingraham Highway and then east to C-111, creating a southern berm upstream of the east-west borrow canal which intersects the canal, converting existing earthen plugs to weirs by scraping them down approximately 1’, and creating new earthen weirs to maximize the established hydraulic gradients. The Aerojet Canal Feature will be fed by a second 225 cfs pump station to be constructed just upstream of S-177 (immediately south of Ingraham Highway).

Alternative 2D Long will be identical to Alternative 2D Short except its southern terminus would be extended to the existing plug located nearly due west of

S-18C, and all existing earthen plugs upstream of the southern terminus would be constructed to weirs.

Alternative 3D contains the same FPDA feature as described for Alternatives 2D Short and 2D Long (225 cfs capacity). The alternative also has the same pump station for the Aerojet Canal feature as Alternative 2D (225 cfs) but instead of feeding the Aerojet Canal, it feeds a proposed 530 acre above ground reservoir to be constructed between the L-31W and Aerojet Canals. In this alternative, the plugs in the northern section of the Aerojet Canal, and the canal become a seepage collection canal served by a third pump station (75 cfs) which pumps seepage back to the reservoir.

Alternative 6D consists of a ten mile long, underground physical seepage barrier. The seepage barrier would run from the northern portion of L-31 West (just west of S-332D) south along the Frog Pond Detention Area to the southern end of the existing Aerojet Canal.

## 7.2 SUMMARY OF AFFECTED RESOURCES

Under the No Action Alternative, there would be a continual degradation of biological communities that are presently exposed to point-source canal discharges; and the estuarine communities along Florida Bay would continue to experience hypersaline conditions adversely affecting the overall health and productivity of these sensitive marine resources. It is not unreasonable to forecast that freshwater wetlands in the project area would be subject to urban and commercial development.

Alternatives 1C, 1D, 2D Short, 2D Long, and 3D would appear to result in similar effects on many of the resources within the study area and immediately adjacent to the project site since they utilize a similar project footprint. Therefore some of the resources in this chapter are impacted by all six alternatives equally. The difference among alternatives, in the cases where they do differ, would be of magnitude rather than type of impact, as the primary objective of all the alternatives is to provide overland flow and hydrological connectivity to rehydrate freshwater wetlands, tidal wetlands, and nearshore bay habitat while reducing point source discharges into Florida Bay.

While Alternative 6D appears to provide the greatest ecological lift, however, its predicted effectiveness coupled with its inoperability represent a tremendous risk to wetland hydroperiods east of the structure, as well as to surface and ground water quality (from a permanent reduction of good quality water which currently seeps to the east).

The most significant beneficial effects associated with all alternatives would be achieved in the coastal wetlands and adjacent estuaries. Generally, project

benefits would increase directly as freshwater is discharged overland through the freshwater wetlands, into the estuaries and along the nearshore of Florida Bay. All alternatives can provide overland flow to hydrate the freshwater wetlands and coastal marine biological communities. Distribution of freshwater flows into the wetland system will improve the salinity regime downstream and result in a healthier estuarine environment.

Specifically, all alternatives should provide meaningful hydrologic and ecologic improvements to the marshlands of Taylor Slough, the Southern Glades, Model Lands, and Everglades National Park (ENP). Any of the action alternatives should provide progress towards implementing an adaptive process that will facilitate better management and understanding of hydrologic influences and salinity relationships in nearshore waters of Florida Bay, and Barnes and Card Sounds and the adjacent coastal wetlands. These improvements in salinity and flow regimes should also increase the spatial extent of species-diverse seagrass beds, increase the species diversity and abundance of estuarine fish and invertebrates, restore more natural wetland vegetation communities, and improve the overall health of the project area.

At the landscape level, completion of the C-111 SC project is important to the management and improvement of resource values of the adjacent conservation areas with Federal interest, such as Everglades National Park, Biscayne National Park, and Crocodile Lake National Wildlife Refuge. In addition to contributing to improving a wide ranging regional landscape for wildlife, the restoration area will conserve infiltration areas to benefit groundwater resources, effecting base flow to sloughs, other flow ways, marshlands, estuarine and bay areas and help to maintain barriers to salt-water intrusion.

Implementation of any alternative should benefit several federally listed species by improving freshwater flow to a variety of habitat types that will result in corresponding beneficial responses throughout the ecosystem. Progress towards lowering salinity in the coastal wetlands should increase productivity of prey fish, thus providing an increase in the forage base of wood storks and state-listed wading birds. In addition, lower salinities in the coastal wetlands should also make the habitat more suitable for hatchling and juvenile crocodiles.

In terms of potential adverse effects as a result of project implementation, there will likely be some short-term and small-scale negative impacts to listed species, such as, disruption of local feeding areas due to project construction activities and habitat for the Cape Sable seaside sparrow that may experience extended hydroperiods exceeding its optimal range. The West Indian manatee may experience periodic localized reduction in freshwater flow in the C-111 Canal below S-197 (in an area that they have been documented to frequent) that may precipitate some redistribution of manatee use in estuarine coastal areas.

### **7.3 PHYSICAL LANDSCAPE: GEOLOGY, TOPOGRAPHY, AND SOILS**

Soils and topography within the project site are expected to change under all alternatives. It is not expected that geology would be impacted under any alternative.

#### **7.3.1 No Action Alternative**

The geologic conditions below the surface would remain relatively unchanged, with the exception of the groundwater. The groundwater would be most affected by the lowering of the water table, caused by decreased areas of recharge, lower canal flow, increase of water demand (i.e., additional wells; residential, agriculture, and industrial), creating altered flow pathways, and a potential for increased salt water intrusion.

Soil conditions may be altered in the agricultural and upland areas by residential and/or industrial development. This soil may be removed, accreted, or built upon. Soils within the upland and coastal wetlands are not expected to be disturbed. In rare instances, some development may occur in wetland areas with proper permitting from the local governing agencies. As a result, these wetland soils would be drained and/or displaced with fill materials to support development.

#### **7.3.2 Alternatives 1C, 1D, 2D Short, 2D Long, 3D, and 6D**

Groundwater would be affected by locally raising the water table caused by increased areas of recharge to aquifers by overland flow, rehydrating aquifers with percolating hyposaline surface water, and a decreased potential for saltwater intrusion.

These alternatives will have the effect of providing more hyposaline and saturated conditions to wetland soils. The alternatives mean the soils will not be potentially subjected to anthropogenic influences in the Frog Pond Agricultural Area and in the L-31W Basin due to the reduction or end of existing agricultural operations in these areas.

### **7.4 CLIMATE**

#### **7.4.1 No Action Alternative**

The observed global warming trend is expected to continue, including an estimated four-inch (ten centimeters) rise in sea level, which could have a significant effect on all coastal and low lying areas. During the period between the present and 2050, south Florida should experience a full multi-decadal cycle of Atlantic hurricane activity. Currently, the area is in an active phase of this

cycle that started in 1995. This active phase followed a 25-year period of low hurricane activity. This suggests that between the present and 2050, the area would complete this active phase, pass through another low activity period, and begin another active phase.

Hydrologic data used for both the existing and future without plan condition are based upon a five-year period from 1995-2000. Wet years were considered to be 1995-1996, dry or drought years were 1999-2000, and a typical, average year was 1998-1999. This period of record used for modeling is assumed to be representative of the range of climatic conditions expected to occur in the study area in the future.

#### **7.4.2 Alternatives 1C, 1D, 2D Short, 2D Long, 3D, and 6D**

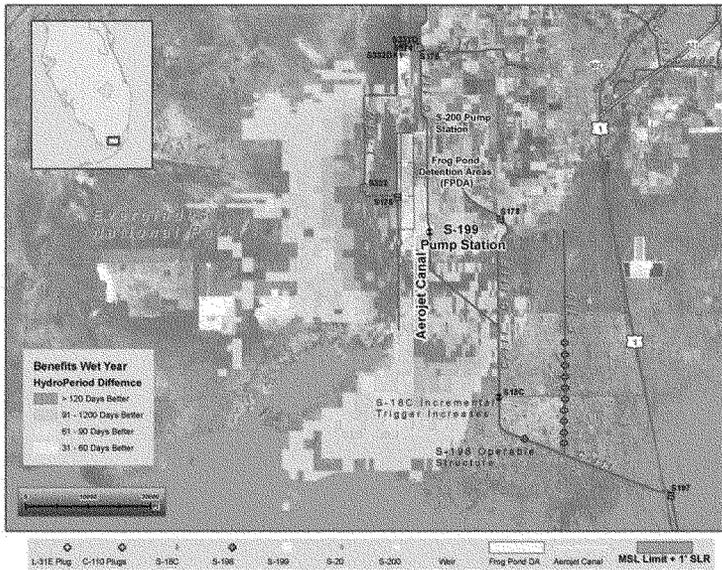
None of the alternatives are anticipated to effect climate patterns in the region.

### **7.5 HYDROLOGY (SEA LEVEL RISE)**

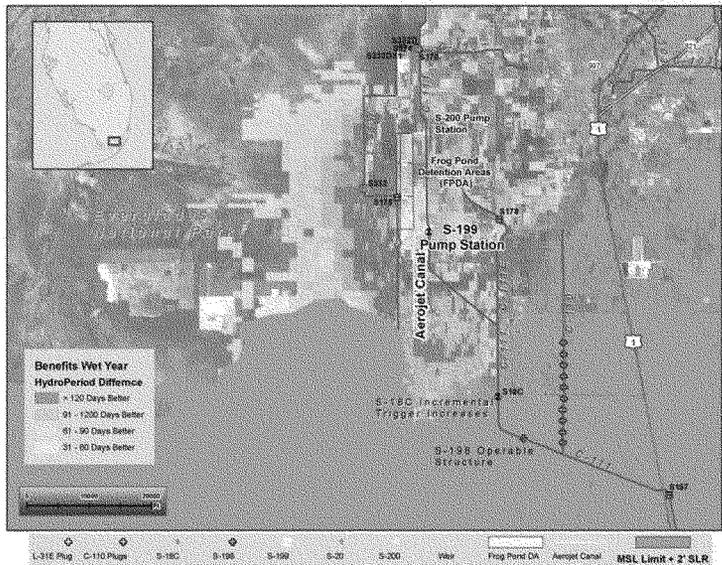
The effects of sea level rise have been analyzed per (EC 1165-2-211). This analysis looked at the effect of sea level rise (SLR) on the benefits predicted for the selected alternative (2DShort). *TABLE 7-1* shows the SLR projections for low, moderate, and high rates and the expected impact of SLR on the primary zones of freshwater wetland benefitted area and salinity habitat benefits expected in this project. The benefit loss estimates are based on the maps shown in *FIGURE 7-1*, *FIGURE 7-2*, and *FIGURE 7-3* of the project area, primary freshwater wetland benefit area and mean sea level (MSL) flood lines under three SLR scenarios. The complete SLR discussion is found in Appendix C.

**TABLE 7-1: EFFECT OF SEA LEVEL RISE ON PROJECT BENEFITS AT 20, 50, AND 100 YEARS**

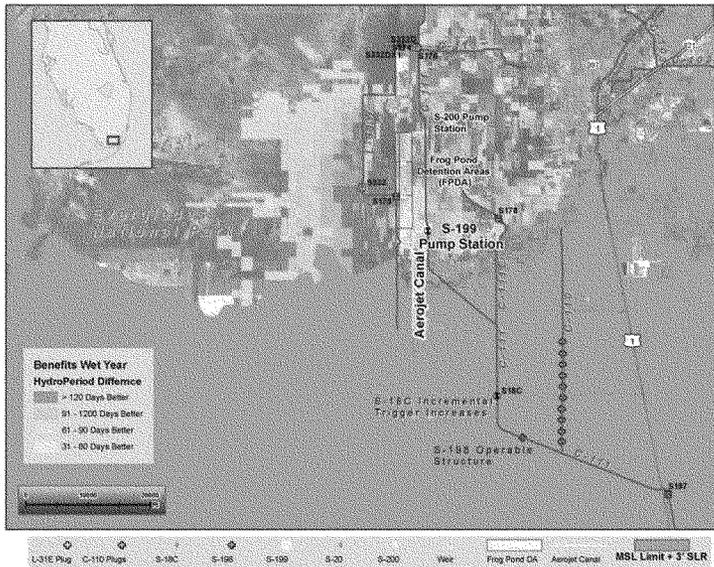
SLR Scenario	Freshwater Wetland Rehydration	Nearshore Salinity Conditions
25-Year Projection		
Low (1.8 inches)	No effect	No effect
Intermediate (3.1 inches)	No effect	Minimal Location Shift
High (7.4 inches)	Minor (<10%)	Location Shift
50-Year Projection		
Low (4.4 inches)	Not Significant	Not Significant
Intermediate (9.1 in)	Minor (10% reduction)	Location Shift
High (24.5 inches)	Significant (33% reduction)	Location Shift
100-Year Projection		
Low (8.8 inches)	Minor (10% reduction)	Location Shift
Intermediate (22.8 inches)	Significant (33% reduction)	Location Shift
High (68.8 inches)	All lost	Location Shift and losses



**FIGURE 7-1: MAP OF FRESHWATER WETLAND BENEFIT AREA UNDER WET YEAR CONDITIONS AND EXISTING MSL + 1 FOOT SLR**



**FIGURE 7-2: MAP OF FRESHWATER WETLAND BENEFIT AREA UNDER WET YEAR CONDITIONS AND EXISTING MSL + 2 FOOT SLR**



**FIGURE 7-3: MAP OF FRESHWATER WETLAND BENEFIT AREA UNDER WET YEAR CONDITIONS AND EXISTING MSL + 3 FOOT SLR**

### 7.5.1 No Action Alternative

Coastal salinity control structures will continue to operate in the future without project condition in accordance with the design operating criteria. However, a continued sea level rise may make it necessary to operate the canals at higher levels to avoid saltwater intrusion. Point source discharge events of freshwater discharge will likely increase in frequency and magnitude due to the expected reduction in groundwater storage availability. The saltwater marsh line along the southern land boundary of the study area would likely move north as freshwater wetland areas convert to saltwater wetlands. Accelerated loss of sawgrass habitat in the southern glades and southern portion of Taylor Slough is expected.

### 7.5.2 Alternatives 1C, 1D, 2D Short, 2D Long, 3D, and 6D

The effects of sea level rise on future study area conditions are expected to be largely similar for all of the with-project alternatives since the location of the main project features are identical (Frog Pond, Aeriojet canal). The analysis effect of SLR on the 2DShort benefits (Shown in *TABLE 7-1*) indicate that within the 20-year planning horizon, no more than 10% of the freshwater

wetland benefits would be at risk to SLR and none of the saltwater habitat benefits. At the end of the 50-year planning horizon, the freshwater wetland rehydration benefits attributed to the selected plan will be diminished as much as 33% as determined by comparing the flood prediction maps for 2 ft of SLR (high projection for 50 years) with the benefited area projection. Nearshore salinity benefits are not expected to be significantly impacted by the 50 year high SLR projection estimate. This is because the nearshore salinity habitat area will move northward into Taylor Slough as mean sea level increases. Limited impacts to project benefits were seen at the low and moderate SLR projections at 50-years. Under the high SLR scenario at 100 years, the project benefits will not occur. As mentioned above, the project is justified based on a 50-year project lifespan. The effects of SLR on project benefits that occur after the 50-year project lifespan should be treated the same as benefits that occur after the project lifespan. In other words, effects that occur after the 50 year project lifespan should not be considered for plan selection or determination of project viability.

There is no doubt that SLR over the last 100 years has impacted Taylor Slough, the southern glades, and the downstream nearshore estuarine habitat. This is evident by the landward migration of the white zone habitat and the abandonment of farming activities in the extreme southern glades. Water management alterations such as the C-111 and L-32N canals have likely exacerbated the impact of past SLR by significantly reducing surface and groundwater deliveries to Taylor Slough and the southern glades. Relevant ecological literature as well as best professional judgment supports the conclusion that augmenting flows to Taylor Slough is critical to preserving the sawgrass habitat and nearshore estuarine salinity conditions downstream. Given the possibility of peat decomposition caused by landward migration of the salt habitat front, it is critical to the Taylor Slough ecosystem that additional freshwater flows are diverted into this basin. Without augmenting Taylor Slough flows, it is apparent that the future without project scenario will result in accelerated loss of the functional sawgrass habitat under intermediate and high SLR projections as compared to the selected project scenario.

## 7.6 WATER MANAGEMENT (OPERATIONS)

Quantities and distributions of water through water management operations can have environmental effects. These effects include changes to water quality, salinity, and inundation of wetlands. The various alternatives may have different environmental effects based on the quantity, timing, and locations of the distributions of water. *TABLE 7-2* shows the predicted flows at critical structures for the existing condition, future without condition and the future with-project alternative conditions. Note that much of the apparent differences between the existing condition baseline (ECB) scenario and the future scenarios is likely due to different model boundary conditions rather than the effects of

different structure operating criteria or project related effects. The differences between the future without project (FWO) and the future with-project scenarios is largely due to the operation of new features since the only change to existing structure operating rules is a slight change to the S-18C open / close schedule intended to result in slightly higher stages upstream of this structure. The water management operations for the different alternatives are outlined below:

Average of 1978, 1989, 1995								
	ECB	FwoCERP	1C	1D	2DShort	2DLong	3D	6D
S332d	54800	127717	125344	125586	122663	124390	123073	135612
S-174	13945	0	0	0	0	0	0	0
S-176	6897	20741	25767	25643	15367	15095	24394	22295
S-177	68353	148373	140824	93406	51251	53023	47648	285504
S-18C	106103	140997	75478	85962	58117	54691	96916	107148
S-197	95521	237798	197186	123581	72073	58715	92302	468129
S-FBDA	0	0	133044	133556	60374	60039	63692	0
S-AJET	0	0	0	0	53957	50159	52663	0
Average Year (1978)								
	ECB	FwoCERP	1C	1D	2DShort	2DLong	3D	6D
S332d	15717	118725	119206	118428	114328	115363	115230	133995
S-174	8175	0	0	0	0	0	0	0
S-176	0	3176	6248	9060	5623	8903	3072	2291
S-177	71576	208592	104711	20248	463	0	19785	359623
S-18C	84772	140653	63639	65448	33530	23769	64211	102414
S-197	108033	346405	213053	81908	26726	13054	62129	589189
S-FBDA	0	0	142004	142706	63087	61829	67692	0
S-AJET	0	0	0	0	59442	57149	57955	0
Dry Year (1989)								
	ECB	FwoCERP	1C	1D	2DShort	2DLong	3D	6D
S332d	203	43886	38361	36853	36858	38270	36094	48670
S-174	22651	0	0	0	0	0	0	0
S-176	0	4790	17546	16609	23950	20826	15255	4009
S-177	0	2	96077	88267	86413	103300	29547	0
S-18C	0	4743	2406	4505	541	0	9071	3875
S-197	0	0	0	0	0	0	0	0
S-FBDA	0	0	13141	13512	5052	4308	5895	0
S-AJET	0	0	0	0	4289	3626	5436	0
Wet Year (1995)								
	ECB	FwoCERP	1C	1D	2DShort	2DLong	3D	6D
S332d	148482	220539	218465	221476	216803	219537	217894	224169
S-174	11009	0	0	0	0	0	0	0
S-176	20692	54258	53507	51259	16529	15554	54853	60584
S-177	133484	236526	221686	171703	66876	55769	93612	496890
S-18C	233537	277595	160389	187932	140279	140303	217467	215156
S-197	178531	366990	378505	288836	189495	163091	214777	815199
S-FBDA	0	0	243987	244450	112983	113981	117490	0
S-AJET	0	0	0	0	98138	89703	94599	0

### 7.6.1 No Action Alternative

CSOP is a water control plan that will define how the SDSCS as well as the WCAs 3A and 3B will be operated based on the structural features in the authorized 1994 C-111 GRR and the 1992 MWD GDM. The operational recommended plan with CSOP in place will be considered as the defining future without for this project area. Currently, two model runs have been completed to define what is considered the minimum and maximum bracketed operational plans for this project taking into consideration full restoration to the ENP (West) and flood control, water supply, and saltwater intrusion (East). Due to concerns raised by the CSOP team, these model runs have not been determined to be the “absolute” maximum and minimums and will only be used for talking purposes during the Feasibility Scoping Meeting.

### 7.6.2 Alternative 1C

This alternative includes FPDB and pump for FPDB, consistent with the State Expedited Construction plan; FPDB approximately 530 acres; the FPDB pump intercepts 2/3 of S-176 flow; FPDB maximum depth of 3 feet. A new operable structure in the lower C-111 (S-198) will reduce overdrainage of adjacent wetlands. A new plug in the L-31E and operational changes at S-20 should help maintain higher marsh levels. The FPDA pump (S-200) should reduce S-177 openings and reduce seepage from Taylor Slough thereby increasing flows to Florida Bay.

### 7.6.3 Alternative 1D

Similar to 1C except this alternative includes two operable structures in the lower C-111, one plug at S-20A, and operational changes at S-20.

### 7.6.4 Alternative 2D Short

Similar to Alternative 1D except the hydraulic ridge will be extended south to the E-W borrow canal. A new 225 cfs capacity pump station, S-200 will route water that is currently discharged through S-177 to the proposed Frog Pond Detention Area (FPDA). The S-200 will operate with triggers that will be slightly lower than that of existing structure, S-177 which currently is operating in accordance with the Interim Operating Plan (IOP). In addition, operational changes will be implemented at existing structures, S-18C and S-20. Refer to *Annex D, Draft Project Operating Manual* (DPOM) for additional operating information regarding operations to be implemented for this alternative.

### 7.6.5 Alternative 2D Long

Similar to Alternative 1D except the (somewhat lower) hydraulic ridge will be extended south to the latitude of S-18C. This alternative includes the FPDA

(approximately 530 acres). A water stage depth of 3 feet is expected to be the maximum stage maintained in FPDA. A pump for FPDA will intercept one third of S-176 flows, a gravity structure upstream of S-177 to discharge into the Aerojet Canal. In addition, there would be two operable structures in the lower C-111, one plug at S-20A, and operational changes would be implemented at S-20.

#### **7.6.6 Alternative 3D**

This alternative includes the FPDA (approximately 530 acres). A water stage depth of 3 feet is expected to be the maximum stage maintained in FPDA. A pump for FPDA will intercept one third of S-176 flows, a gravity structure upstream of S-177 to discharge into the Aerojet Canal. In addition, there would be two operable structures in the lower C-111, one plug at S-20A, and operational changes would be implemented at S-20.

#### **7.6.7 Alternative 6D**

This alternative would include the construction of a seepage barrier that would extend from northern portion of L-31 W(just west of S-332D), south along the FPDA to the southern end of the Aerojet Canal, two operable structures in the lower C-111, one plug at S-20, and operational changes at S-20.

### **7.7 FLOOD CONTROL**

#### **7.7.1 No Action Alternative**

Flooding has been a concern for all residents of Miami-Dade County. In the future, flooding would still be a concern in spite of millions of dollars in capital improvement projects from local, state and federal governments, many areas could still suffer repeated flood damages in the future, due to large storms, above the water management system capacity. As agricultural land use changes to urban, and wetland encroachment continues, the number and extension of flooded areas may increase. The actual level of service may be reduced, particularly the low-lying areas, developed prior to the implementation of the current flood criteria standards and agricultural land encroached by urban development. The C-111 SC project may create opportunities to explore the improvement the water management system and level of service in south Miami-Dade County.

#### **7.7.2 Alternatives 1C, 1D, 2D Short, 2D Long, 3D, and 6D**

None of the alternatives are anticipated to result in an impact to the level of service for flood protection. The nearest housing stock and agricultural interest are to the north and east of the project footprint, and hydrologic modeling shows no project induced damages. The savings analysis contains the data supporting

the no impact statement. The alternatives were not formulated to increase the level of service for flood protection.

## 7.8 WATER QUALITY

Future water quality conditions in the lower C-111 Basin will be strongly influenced by land use as well as the quantity and timing of flows delivered to the basin. The Settlement Agreement requirements discussed in *Section 2 (Existing Conditions/Affected Environment)* will likely remain as the primary means of determining compliance with water quality standards. In the Settlement Agreement, the Taylor Slough long-term phosphorus limit is set to 11 parts per billion (ppb) as measured by the flow-weighted concentrations at the S-332D, S-174, and S-18C structures. Recent compliance results indicate that the annual flow-weighted average total phosphorus (TP) concentration for the Taylor Slough compliance locations has been below 8 ppb since 2001 and is trending towards 5 ppb. This downward trend is likely to continue as more of the land upstream of the C-111 Basin converts from agriculture to urban or commercial uses.

Differences in water quality impacts are expected to be strongly linked to changes in flow patterns since none of the alternatives include dedicated water quality treatment features. The MODBRANCH model surface water flow simulation results can be used to determine the relative changes to water flow patterns and nutrient loading to Taylor Slough as well as Barnes Sound. The average flows from C-111 structures for the three MODBRANCH simulation years (1978, 1989, and 1995) are shown in *TABLE 7-2* for existing hydrologic conditions model runs (ECB) and future hydrologic conditions model runs (FWO). For each set of hydrologic condition simulations, the alternatives are ranked according to their expected relative phosphorus loading and salinity impacts to Taylor Slough and to Barnes Sound. In addition, total “Revised Settlement Agreement Flows” are provided to show changes in surface flows to Taylor Slough and the Panhandle. The issue of nitrogen loading impacts to the nearshore and Florida Bay is not addressed in this PIR since this project will result in a relatively small increase in total nitrogen loading to Florida Bay as compared to other restoration projects such as Modified Water Deliveries. The relative impact of flow diversions to Taylor Slough is shown in *TABLE 7-2* by ranking S-18C flows from lowest to highest. Alternatives that have relatively low flow through the S-18C structure generally send more water through Taylor Slough. For Barnes Sound, the ranking of relative impacts is based on the average flow through the S-197 structure. Alternatives that send more flow through this structure are likely to cause a greater incidence of large salinity swings as well as high nutrient load delivery to Barnes Sound.

Surface water flows will not be directly discharged into Taylor Slough or ENP as a result of any of proposed project alternatives. Under most of the alternative

plans, water will be pumped into the Frog Pond Detention Area and Aerojet Canal. The water will then infiltrate into the ground and form a hydraulic ridge, blocking water from seeping into the C-111 Canal. The Frog Pond Detention Area and the Aerojet Canal feature are not designed for water quality treatment. These features may provide some nutrient removal and sedimentation or filtration of infiltrated water that will reduce pollutant loading downstream. There may be some negative effects on vegetation along the eastern boundary of ENP, most likely cattail growth, as a result of water seepage to the west out of the two Detention Areas. These effects are likely to be extremely minimal, and would likely only occur along the immediate edges of the two Detention Areas. The spread of cattails further into ENP is unlikely to occur due to the high quality of the water in the C-111 Canal in this area and the limited seepage that would occur to the west with the absence of any substantial flow gradient in that direction.

The closest rock mining operations in the area are located east of US Highway 1 south of Florida City and are approximately 6 miles from the main project features. Mining operations in South Miami-Dade County are done in the wet due to difficulty in dewatering the excavations. The impact on water quality and groundwater stage caused by these mines is limited to lands directly adjacent to the excavations. Thus, none of the considered with-project alternatives should be impacted by mining operations.

**TABLE 7-2: SIMULATED FLOWS AT CRITICAL C-111 BASIN STRUCTURES**

<b>Existing Conditions (ECB) Model Runs</b>							
<b>Annual Average Flow (ac-ft/yr)</b>							
	ECB	ECB 1C	ECB 1D	ECB 2DS	ECB 2DL	ECB 3D	ECB 6D
S332d	54800	56051	56791	45433	40748	44770	57579
S-174	13945	14476	15384	12882	17620	14596	6226
S-176	6897	10587	10917	5554	6534	7834	7289
S-177	68353	68156	63258	26534	32101	46302	131485
S-18C	106103	45011	43828	37749	36874	64825	44932
S-197	95521	103154	77240	38186	49181	76368	206976
S-FBDA	0	86687	90601	42101	36806	42930	0
S-AJET	0	0	0	37974	35017	31863	0
Revised Settlement Agreement Flows	160903	187748	191220	163257	149444	184388	102512
Relative Impact to Taylor Slough (Based on ranking S-18C Flows from low to high) 2DL>2DS>1D>6D>1C>3D>ECB							
Relative Impact to Barnes Sound (Based on ranking S-179 Flows from low to high) 2DS>2DL>3D>1D>ECB>1C>6D							
<b>Future Conditions (FWO) Model Runs</b>							
<b>Average Annual Flow (ac-ft/yr)</b>							
	FWO	FWO 1C	FWO 1D	FWO 2DS	FWO 2DL	FWO 3D	FWO 6D
S332d	127717	125344	125586	122663	124390	123073	135612
S-174	0	0	0	0	0	0	0
S-176	20741	25767	25643	15367	15095	24394	22295
S-177	148373	140824	93406	51251	53023	47648	285504
S-18C	140997	75478	85962	58117	54691	96916	107148
S-197	237798	197186	123581	72073	58715	92302	468129
S-FBDA	0	133044	133556	60374	60039	63692	0
S-AJET	0	0	0	53957	50159	52663	0
Revised Settlement Agreement Flows	268714	333866	345104	295110	289279	336344	242760
Relative Impact to Taylor Slough (Based on ranking S-18C Flows from low to high) 2DL>2DS>1C>1D>3D>6D>FWO							
Relative Impact to Barnes Sound (Based on ranking S-179 Flows from low to high) 2DL>2DS>3D>1D>1C>FWO>6D							
* Revised Settlement Agreement Flows = S-332D+S-18C+S-FBDA+S-AJET							

### 7.8.1 No Action Alternative

The “No Action Alternative”, sometimes referred to as the “Future Without Alternative”, or FWO, does not include changes to operations or the construction of new features. The continued conversion of agricultural lands to residential lands upstream of the Lower C-111 Basin should result in the continued maintenance of low phosphorus concentrations in surface water sent to Taylor Slough. Under the No Action Alternative, future water quality conditions in the lower C-111 Basin will be greatly influenced by the volume and quality of surface water delivered through the C-111 and L-31W canals. These flows are expected to increase primarily as a result of the implementation of the Modified Water Deliveries project which is scheduled to precede full CERP implementation. Relative to the existing condition (ECB) results, the FWO model results for flows at S-332D and S-197 show that the future No Action Alternative condition will result in additional flows and nutrient loads to Taylor Slough as well as to Barnes Sound. The ecological impact to the Taylor Slough freshwater wetlands resulting from the additional phosphorus should be minimal since TP concentrations are expected to remain below the Settlement Agreement compliance standard and near the background concentration for TP. The increase in flow to Taylor Slough should also result in more favorable salinity conditions in the downstream nearshore estuarine areas such as Little Madeira Bay and Joe Bay.

### 7.8.2 Alternative 1C

This alternative includes a 450 cfs pump station and a 530 acre detention area located in the Frog Pond. The ongoing conversion of agricultural lands to residential lands upstream of the Lower C-111 Basin should result in the continued maintenance of low phosphorus concentrations in Taylor Slough. The cessation of farming operations within the Frog Pond area will reduce the associated nutrient and pesticide loads that presently may be sent to Taylor Slough. Under existing or future hydrologic conditions, this alternative will increase flows and nutrient loads to Taylor Slough as compared to the No Action Alternative. The increased freshwater deliveries to Taylor Slough will reduce average salinity conditions within the downstream estuary which is considered to be beneficial; however, some additional nitrogen loading will be delivered to the estuarine areas. If “Revised Settlement Agreement” flows are used as an indication of nutrient load diversion, then this project can be said to increase loads to Taylor Slough and the Panhandle by approximately 17% (160,900 to 187,700 ac-ft/yr) under present hydrologic conditions and 24% under future hydrologic conditions. Since the concentration of TP in the water sent to Taylor Slough will be less than the standard established by the 1991 Settlement Agreement, diverted water quality is expected to be compliant with applicable criteria. Adverse water quality related impacts to freshwater wetlands should be minimal since the average flow-weighted TP concentration in Basin water is

expected to remain around 5 ppb which is very close to the background concentration for TP.

Under existing hydrologic conditions, this alternative will result in an approximate 10% increase in flows through the S-197 structure which discharges to Barnes Sound. Since S-197 discharges are generally regarded as undesirable because the cause rapid changes to nearshore salinity conditions, this projected increase in these discharges is regarded as unfavorable. Under future hydrologic conditions, this alternative will result in an approximate 20% decrease in S-197 discharges. This is regarded as desirable. Overall, this alternative is expected to cause limited harm to Barnes Sound in the short term while resulting in an improvement to this area in the long-term.

### 7.8.3 Alternative 1D

This alternative includes a 450 cfs pump station and a 530 acre detention area located in the Frog Pond. This alternative like all "D series" alternatives will include the plug in L-31E at S-20A, modified S-20 operations, and will include the structure S-198 (S197-like structure) in the lower C-111 just as the previous model runs have done. Otherwise, Alternative 2D has the same features as Alternative 1C. The ongoing conversion of agricultural lands to residential lands upstream of the Lower C-111 Basin should result in the continued maintenance of low phosphorus concentrations in Taylor Slough. The cessation of farming operations within the Frog Pond area will reduce the associated nutrient and pesticide loads that presently may be sent to Taylor Slough. Under existing or future hydrologic conditions, this alternative will increase flows and nutrient loads to Taylor Slough as compared to the No Action Alternative. The increased freshwater deliveries to Taylor Slough will reduce average salinity conditions within the downstream estuary which is considered to be beneficial. Based on the Revised Settlement Agreement flows this alternative can be said to increase loads to Taylor Slough and the Panhandle by approximately 19% under present hydrologic conditions and 28% under future hydrologic conditions. Adverse water quality related impacts to freshwater wetlands should be minimal since the average flow-weighted TP concentration is expected to remain around 5 ppb which is very close to the background concentration for TP. Since the concentration of TP in the water sent to Taylor Slough will be less than the Settlement Agreement standard, diverted water quality is expected to be compliant with applicable criteria.

Under existing and future hydrologic conditions, this alternative will result in a decrease in flows through the S-197 structure which discharges to Barnes Sound. Since S-197 discharges are generally regarded as undesirable because they cause rapid changes to nearshore salinity conditions, this projected decrease in these discharges is regarded as favorable. Overall, the alternative is

expected to improve water quality conditions in Barnes Sound through reduced incidence of salinity swings resulting from pulse discharges.

#### **7.8.4 Alternative 2D Short**

This alternative includes a 225 cfs pump station at the 530 acre Frog Pond Detention Area and a 225 cfs pump to distribute water to the Aerojet Canal. This alternative like all “D series” alternatives will include the plug in L-31E at S-20A, modified S-20 operations, and will include the structure S-198 (S197-like structure) in the lower C-111 just as the previous model runs have done. Under existing or future hydrologic conditions, this alternative will increase flows and nutrient loads to Taylor Slough as compared to the No Action Alternative. The increased freshwater deliveries to Taylor Slough will reduce average salinity conditions within the downstream estuary which is considered to be beneficial. Base on the Revised Settlement Agreement this alternative can be said to increase loads to Taylor Slough and the Panhandle by approximately 1% under present hydrologic conditions and 10% under future hydrologic conditions. Adverse water quality related impacts to freshwater wetlands should be minimal since the average flow-weighted TP concentration is expected to remain around 5 ppb which is very close to the background concentration for TP. Since the concentration of TP in the water sent to Taylor Slough will be less than the standard Settlement Agreement, diverted water quality is expected to be compliant with applicable criteria.

Under existing and future hydrologic conditions, this alternative will result in a decrease in flows through the S-197 structure which discharges to Barnes Sound. Since S-197 discharges are generally regarded as undesirable because they cause rapid changes to nearshore salinity conditions, the projected decrease in these discharges is regarded as favorable. Overall, this alternative is expected to improve water quality conditions in Barnes Sound through reduced incidence of salinity swings resulting from pulse discharges.

#### **7.8.5 Alternative 2D Long**

This project is similar to Alternative 2D Short with the exception that a couple of existing plugs in the Aerojet Canal will be removed to allow water to flow the entire length of this canal. The water quality related impact of this alternative is expected to be similar to that of 2D Short. Under existing or future hydrologic conditions, this alternative will increase flows and nutrient loads to Taylor Slough as compared to the No Action Alternative. The increased freshwater deliveries to Taylor Slough will reduce average salinity conditions within the downstream estuary which is considered to be beneficial. Based on the Revised Settlement Agreement flows, this alternative can be said to decrease loads to Taylor Slough and the Panhandle by approximately -7% under present hydrologic conditions and increase flows by 8% under future hydrologic

conditions. Adverse water quality related impacts to freshwater wetlands should be minimal since the average flow-weighted TP concentration is expected to remain around 5 ppb which is very close to the background concentration for TP. Since the concentration of TP in the water sent to Taylor Slough should continue to be less than the standard Settlement Agreement, diverted water quality is expected to be compliant with applicable criteria.

Under existing and future hydrologic conditions, this alternative will result in a decrease in flows through the S-197 structure which discharges to Barnes Sound. Since S-197 discharges are generally regarded as undesirable because they cause rapid changes to nearshore salinity conditions, the projected decrease in these discharges is regarded as favorable. Overall, this alternative is expected to improve water quality conditions in Barnes Sound through reduced incidence of salinity swings resulting from pulse discharges.

### **7.8.6 Alternative 3D**

Alternative 3D contains the same FPDA feature as noted above for Alternative 2D Long. The alternative also has the same pump station (225 cfs) for the Aerojet Canal feature as Alternative 2D Long but instead of feeding the Aerojet Canal, it feeds a proposed 530 acre above ground reservoir to be constructed between the L-31W and Aerojet Canals. Under existing or future hydrologic conditions, this alternative will increase flows and nutrient loads to Taylor Slough as compared to the No Action Alternative. The increased freshwater deliveries to Taylor Slough will reduce average salinity conditions within the downstream estuary which is considered to be beneficial. Based on the Revised Settlement Agreement flow volumes, this alternative can be said to increase loads to Taylor Slough and the Panhandle by approximately 15% under present hydrologic conditions and by 25% under future hydrologic conditions. Adverse water quality related impacts to freshwater wetlands should be minimal since the average flow-weighted TP concentration is expected to remain around 5 ppb which is very close to the background concentration for TP. Since the concentration of TP in the water sent to Taylor Slough should continue to be less than the standard Settlement Agreement, diverted water quality is expected to be compliant with applicable criteria.

Under existing and future hydrologic conditions, this alternative will result in a decrease in flows through the S-197 structure which discharges to Barnes Sound. Since S-197 discharges are generally regarded as undesirable because they cause rapid changes to nearshore salinity conditions, this projected decrease in these discharges is regarded as favorable. Overall, this alternative is expected to improve water quality conditions in Barnes Sound through reduced incidence of salinity swings resulting from pulse discharges.

### 7.8.7 Alternative 6D

This alternative consists of a ten mile long, in ground seepage barrier. The seepage barrier will run from the northern portion of L-31 West (just west of S-332D) south along the Frog Pond Detention Area to the southern end of the existing Aerojet Canal. The seepage barrier is intended to reduce the volume of “hydraulic ridge” water that seeps back to the C-111 Canal and has to be pumped to the west to the Taylor Slough headwaters. Under existing or future hydrologic conditions, this alternative will increase flows and nutrient loads to Taylor Slough as compared to the No Action Alternative. However, this alternative provides the least increase in Taylor Slough flows when compared to any of the other alternatives and also the least impact in terms of the potential for additional phosphorus loading to the slough. The increased freshwater deliveries to Taylor Slough will reduce average salinity conditions within the downstream estuary which is considered to be beneficial. Based on the Revised Settlement Agreement flows, this project can be said to decrease loads to Taylor Slough and the Panhandle by approximately 36% under present hydrologic conditions and by 10% under future hydrologic conditions. Though this project would reduce nutrient loading to the Taylor Slough freshwater wetlands which is generally considered beneficial, the reduction in hydration is undesirable.

Under existing and future hydrologic conditions, this alternative will result in an increase in flows through the S-197 structure which discharges to Barnes Sound. Since S-197 discharges are generally regarded as undesirable because they cause rapid changes to nearshore salinity conditions, this projected increase in these discharges is regarded as undesirable. Overall, this alternative is expected to degrade water quality conditions in Barnes Sound through increased incidence of salinity swings resulting from pulse discharges.

### 7.8.8 Summary

Relative to the No Action Alternative, most of the with-project alternatives will provide enhanced water quality conditions to Barnes Sound by reducing S-197 flows. Alternative 6D will greatly increase S-197 flows (as compared to the No Action Alternative) which would cause significant harm to Barnes Sound by delivering large pulse loads of freshwater as well as nutrients. Alternatives 2D Short and 2D Long provide the greatest reduction in S-197 flows and thus would likely provide the greatest benefit to this portion of the project area.

Diversion of water to Taylor Slough is a major goal of this project since it will rehydrate these freshwater wetlands as well as beneficially change salinity in the downstream nearshore estuary (Joe Bay, Little Madeira Bay). Alternatives 2D Short and 2D Long provide the greatest opportunity to improve Taylor Slough hydration and downstream salinity since they route the highest proportion of C-111 flows to the east. Of course, sending more water to Taylor

Slough will increase nutrient deliveries to these oligotrophic freshwater wetlands. Given that flow-weighted TP concentrations as demonstrated by the most recent Settlement Agreement are approximately 5 ppb, the impact to native vegetation in the Taylor Slough freshwater wetlands resulting from the increased TP loading is expected to be minimal. With project vegetation changes are more likely to be related to improved hydration as well as elevated soil nutrient concentrations already present in soils. (Increased soil phosphorus concentrations in Taylor Slough are most likely the result of discharges that occurred prior to 2000 when the average flow-weighted TP concentrations for Taylor Slough were in excess of 10 ppb.).

Overall, Alternatives 2D Short and 2D Long provide the greatest opportunity to improve water quality conditions within the project area.

## 7.9 VEGETATIVE COMMUNITIES

The primary factors influencing the distribution of vegetation in this region are hydropattern, salinity, previous disturbance, and to a lesser extent, nutrient loading and soil type. The dominant vegetation community in the region is a matrix of sawgrass prairie with tree islands. The tree islands vary in vegetation composition, depending upon elevation. At the highest elevations, the sawgrass prairie alternates with forested wetlands. At the lowest elevations near the coast, mangroves replace the freshwater wetlands. The transition zone between the mangroves and the freshwater prairie is a needle rush-salt grass zone on the freshwater side, but stunted scrub mangrove on the coastal side. The plant community types present in the SDWMA include sawgrass glades, spike rush and beak rush flats, muhly prairie, cypress stands, native dominated forested wetlands, tree islands, mangrove flats, hydric hammocks, and exotic-dominated forests.

### 7.9.1 No Action Alternative

It is likely that native forested/shrub wetlands and graminoid marshes east of Card Sound Road not in public ownership will not exist as a natural area due to urban development. Future development would also have numerous secondary effects. The wetlands in the northern part of the sawgrass marshes in the Model Lands could transition from a sawgrass-dominated marsh to cattail-saltbush-dominated wetlands due to poor water quality from residential runoff and decline of available freshwater.

Changes in availability and distribution of freshwater and further disruption of natural sheet flow from discontinuities in hydrology due to levees, roads and canals will further exacerbate the changes occurring in the natural freshwater graminoid marshes, forested/shrub wetlands, marl prairie, tree island, and mangrove ecotones. Sea level rise will create the potential for further expansion

of salt tolerant plant species, especially mangroves, into the freshwater marsh areas. Disruption of natural fire cycles and extent can have several effects that will increase in the future without project scenario. Control of fire intensity and extent due to potential for impacts on human infrastructure can encourage establishment of woody plant species that would normally be eliminated as well as selection against more fire tolerant species such as sawgrass and muhly grass. Reduction of water availability can cause fires to burn more intensely than natural, killing plant species that would normally survive a more natural “cool burning” fire as well as permitting organic soils to burn. Concurrently, unnatural flooding can inhibit fires and beneficial vegetation changes. All of these processes will be exacerbated due to increased urbanization in the future.

Urbanization and associated habitat changes and anthropogenic effects (e.g., pets, exotic species releases, and wildlife mortality) will negatively affect native vegetative and wildlife species number and occurrence. These effects are expected to worsen in without the benefits accrued from the project.

Tree islands, an important component of the Everglades habitat for a variety of native plant species not adapted to growing directly in flooded marshes, are being variously impacted by changes in water management and invasion of exotic plant species. The No Action Alternative appears to offer little benefit to offset these ongoing detrimental effects.

The impacts resulting from unauthorized ATV usage in the natural areas include killing the vegetation and changing the microtopography of the area. This has implications for the hydrology and vegetation, which are very sensitive to slight (inches) changes in topography. ATV usage and its associated detrimental effects to the environment should increase due to the anticipated increase in population in or near the project area.

### **7.9.2 Alternatives 1C, 1D, 2D Short, 2D Long, 3D, and 6D**

Each of the alternatives would be effective in hydrating the sawgrass prairies that constitute the freshwater wetlands west of L-31 W Canal along Taylor Slough, and the coastal wetlands downstream adjacent to Florida Bay. The increased hydroperiods are expected to expand the sawgrass and muhly grass dominated wetlands in Vegetative Zone 3 (Figure 2-2) while creating some non-vegetated deep water habitat suitable for juvenile fishes. Overall, a healthier diverse habitat more representative of historical vegetation is anticipated for this area. Further seaward, there will be a reduction of the spatial extent of the more salt-tolerant vegetative types in zones 4 (mixed graminoids), 5 (dwarf mangroves), and 6 (coastal forest). Some sediment deposition is anticipated throughout the watershed, the results of which will be documented as part of the ecological monitoring plan.

## 7.10 FISH AND WILDLIFE RESOURCES

### 7.10.1 No Action Alternative

The region supports a variety of wetland dependent wildlife, including several federally and state-listed endangered and threatened wildlife species. A reduction of the wetland function and value of coastal and inland habitats within and adjacent to the C-111 SC Western project area associated with the spread of development and land conversion, will result in an overall loss of fish and wildlife resources within the project area in the future. Disruption of the natural hydrology has resulted in aquatic vegetation community changes and a resultant disruption of aquatic productivity and function that has had repercussions throughout the food chain, including effects on wading birds, raptors, larger predatory fishes, reptiles (crocodiles and alligators), and mammals. These effects will undoubtedly worsen given demands associated with environmental changes under a no action alternative.

Productivity of native fish species, many important as prey species for wading birds, has been and will continue to be depressed due to water management practices and other factors previously discussed.

Introduction and spread of a wide range of exotic fish species has increasingly been problematic in the project study area. The causative factors for this exotic fish problem include illegal introductions, unnatural habitat due to construction of canals and impoundments, and the establishment of vectors for travel and refugia (linear canals and deeper water) unlike the natural Everglades environment. Evaluation of the effects on occurrence and productivity of native fish species is controversial at best, but some studies report that the effect is negative and will be exacerbated under a no action alternative.

Maintenance of the popular sport fishery for non-native species such as the butterfly peacock (*Cichla ocellaris*), and native largemouth bass (*Micropterus salmoides*) should remain largely unaffected in the No Action Alternative.

### 7.10.2 Alternatives 1C, 1D, 2D Short, 2D Long, 3D, and 6D

Presently, there are an estimated total of forty-five fish species, fourteen amphibian species, forty-six reptilian species, fourteen mammalian species, and 178 avian species documented to occur throughout the project area. Each alternative has the capability of freshwater distribution to both freshwater and coastal wetlands subsequently increasing the functional values of habitats utilized by these fish and wildlife resources in the area. Therefore, implementation of any of the alternatives has the capacity to enhance the viability of wading birds, raptors, larger predatory fishes, reptiles, and mammals that presently inhabit the project area.

## 7.11 THREATENED AND ENDANGERED SPECIES

The FWS has been an active member of the project team for the C-111 SC Western project and has provided guidance through informal consultation during plan formulation and evaluation on the potential effects the proposed project may have on federally listed threatened and endangered species that may be present in the project study area. The USACE has also coordinated with the National Marine Fisheries Service, Protected Resource Division, on proposed impacts to species under their purview.

### 7.11.1 No Action Alternative

Without the environmental benefits of the C-111 SC Western project, urbanization, water demands, direct loss of habitat, and other demands for land, as well as degradation of existing habitat function will likely result in a continued decline in populations of threatened, endangered, and state listed species.

### 7.11.2 Alternatives 1C, 1D, 2D Short, 2D Long, 3D, and 6D

Species and critical habitat identified during informal consultation as potentially affected by the proposed project include twenty-one federally listed threatened or endangered species; along with designated critical habitat for the American crocodile, Everglade snail kite, West Indian manatee, the Cape Sable seaside sparrow (CSSS), elkhorn coral, and staghorn coral. C-111 SC Western project impacts to threatened and endangered species are considered significant (although largely beneficial) but would be similar for all alternatives.

All of the project alternatives, with the exception of the no-action plan, are expected to increase hydroperiods and water depths in subpopulation D of designated critical habitat for the CSSS. These anticipated changes are expected to reduce suitable habitat and nesting opportunities for this subspecies. Formal coordination with the FWS is in progress to seek opportunities to minimize adverse impacts to both the CSSS and its designated critical habitat.

With the exception of the CSSS, implementation of any of the alternatives will enhance the habitat functional capacity necessary to sustain threatened and endangered species within and adjacent to the project area.

## 7.12 NON-NATIVE VEGETATION

Invasive species present in the C-111 SC Western project area include melaleuca (*Melaleuca quinquenervia*), Australian pine (*Casuarina* spp.), and Brazilian pepper (*Schinus terebinthifolius*), among others. The heaviest impacts from

invasive species tend to occur in disturbed areas within the SDWMA, such as abandoned farmland and lands in the immediate vicinity of roads and berms. Such areas are frequently dominated by nearly monotypic stands of invasive plants. Elsewhere, these invasive plants are present in smaller, but no less important numbers in tree islands, marshes, and mangrove forests as a result of long distance seed dispersal. In other regions of the county, such outlier populations have rapidly expanded to create additional problems when left untreated.

#### **7.12.1 No Action Alternative**

An increase is anticipated in the No Action Alternative project scenario in the spatial coverage of invasive non-native plant species, such as Brazilian pepper (*Schinus terebinthifolius*), Australian pine (*Casuarina* spp.), and melaleuca (*Melaleuca quinquenervia*) due to land disturbance and projected lower water levels. With the lack of project monitoring and maintenance, there would be an increase in other exotic plants including shoebutton ardisia (*Ardisia elliptica*) and old world climbing fern (*Lygodium* spp.). The spread of all these invasive non-native plant species has resulted in the conversion of large acreages with a variety of native vegetative species to less diverse and in some cases mono-specific vegetative cover with reduced value as wildlife habitat.

#### **7.12.2 Alternatives 1C, 1D, 2D Short, 2D Long, 3D, and 6D**

All of the alternatives include redistribution of freshwater into wetland communities that will retard the growth and spread of invasive, non-native plant species. Implementation of any of the alternatives will allow for the successful return of native vegetation to areas hydrated.

### **7.13 ESSENTIAL FISH HABITAT**

#### **7.13.1 No Action Alternative**

Continued point source discharges of canal water through S-197 into Barnes Sound and northeastern Florida Bay will exasperate the ability of affected organisms to sustain productivity levels generally consistent with natural marine communities. The absence of freshwater overland flow into the coastal areas of Florida Bay will promote hyper-saline conditions in the nearshore and estuarine biological communities, thus reducing the survivorship of juvenile shrimps and fishes resulting in a reduction of the functional capacity and overall spatial extent of those systems. A No Action Alternative project scenario is likely to result in an overall decrease in the abundance and diversity of species within those habitats.

### 7.13.2 Alternatives 1C, 1D, 2D Short, 2D Long, 3D, and 6D

The proposed redistribution of freshwater flow into Florida Bay via Taylor Slough is expected to restore or enhance freshwater wetlands, tidal wetlands, and nearshore bay habitat. Sustained lower-than-seawater salinities are required in tidal wetlands and the nearshore bay to provide nursery habitat for fish and shellfish. The C-111 SC Western project is expected to create conditions that will be conducive to the re-establishment estuarine communities. Diversion of canal discharges into coastal wetlands is expected not only to re-establish productive nursery habitat all along the shoreline but also to reduce the abrupt freshwater discharges that are physiologically stressful to fish and benthic invertebrates in the bay near canal outlets.

The C-111 SC Western project is located in areas designated as EFH for corals, live bottom habitat, red drum (*Sciaenops ocellatus*), shrimp, spiny lobster (*Panulirus argus*), other coastal migratory pelagic species and the snapper-grouper complex. Species generally present in the Florida region include brown shrimp, pink shrimp, white shrimp, spiny lobster, stone crab, gulf stone crab, red drum, Spanish mackerel, gray snapper (juvenile and adult). Specifically, EFH in Florida Bay is comprised of seagrasses, estuarine mangroves, intertidal flats, estuarine water column, live/hard bottoms, and isolated stony corals.

With improvements in water deliveries and quality, the appropriate conditions for sensitive estuarine biota, such as species dependent on this habitat for egg, larval, and juvenile stages, are anticipated to benefit or rebound. These impacts are largely beneficial and are significant, and do vary in degree of improvement between alternatives.

All of the construction features of the alternatives are upstream of EFH and any juvenile or adult habitat for the listed species. Standard BMPs to reduce erosion and downstream turbidity will be included in the construction specifications. Construction of any of the alternatives should have no negative impacts on EFH or federally managed fisheries in Florida Bay.

## 7.14 LAND USE

### 7.14.1 No Action Alternative

A review of various local governments (county and municipality) comprehensive plan future land use maps indicate that the portion of the study area lying within the Urban Development Boundary (UDB) is designated as "Estate" and "Low Density Residential" land uses, which ranges in density from two and a half to six dwellings per acre. Much of the future development within the study area will occur on lands that are currently in agricultural use. Additionally, a

majority of land currently designated for agricultural use and lying outside of the UDB but within the Urban Expansion Area (UEA) is projected to be developed with similar uses once the UDB is expanded. Based on increasing residential demand in this area, it is highly probable that this section of the UDB will be expanded within the next ten years.

In areas east and south of the UDB but landward of the coastal areas, at least some continued conversion of undeveloped lands designated in the county land use map as “Open Lands” to rock mines and some undeveloped lands designated as “Agriculture” to construction/demolition debris landfills is possible. In addition, pressure to remove conservation easements on wetland mitigation areas within the UDB to allow development is already occurring. In cases where existing (and/or future) wetland mitigation areas are developed, additional mitigation areas would be needed to offset the loss of wetland functional values. However, based on development pressures, land costs, and the proximity of the FP&L mitigation bank, it is likely that the additional mitigation would be in the form of wetland enhancement, resulting in a further net loss of the spatial extent of wetlands and other open lands within the study area.

Portions of the coastal areas adjacent to BNP that are currently designated in the county land use map as “Environmental Protection” and “Environmentally Protected Parks” within the C-111 SC Western project study area are anticipated to remain in this use. However, the remaining undeveloped coastal areas landward of the environmental protection designation within the UDB are expected to be developed within the next ten to 15 years. With a few exceptions such as the expansion of Turkey Point Power Plant, the remaining coastal wetland areas adjacent to BNP and outside the UDB are likely to remain largely unfilled and undeveloped.

#### **7.14.2 Alternatives 1C, 1D, 2D Short, 2D Long, 3D, and 6D**

The implementation of the C-111 SC Western project will not significantly alter the current land use of the study area; instead, the project will restore the functionality and preserve some of the limited remaining wetlands in southern Miami-Dade County. A majority of the land that is being utilized for the C-111 SC Western project is either nearshore or saltwater wetlands, and would not be developable in the absence of a project. As mentioned in the without project condition, there is a high likelihood that in the absence of a project, the existing freshwater wetlands and open lands would be pressured from agricultural and urban developers.

## **7.15 RECREATIONAL RESOURCES**

### **7.15.1 No Action Alternative**

As part of the without-project conditions, all of the regions in the State of Florida are expected to have significant increases in demands for the selected recreation activities with a commensurate need to increase development of the regions' recreation resources and facilities. Ecosystems support a significant amount of outdoor recreation in the Lower East Coast of Florida. A significant portion of the expenditures comes from tourists. Recreational activities that are projected to have a lack of supply within the Statewide Comprehensive Outdoor Recreation Plan (SCORP) Region 11 are: hiking, freshwater fishing, tent camping, hunting, fresh and saltwater beach activities and bicycle riding.

### **7.15.2 Alternative 1C, 1D, 2D Short, 2D Long, 3D, and 6D**

The Frog Pond Detention Area (FPDA) Alternatives 1C and 1D are not likely to adversely affect the existing recreation within the project area. Some temporary interruption of existing recreation activities (i.e., birdwatching, nature study,) may occur during construction, but would cease after construction had been completed.

All proposed alternatives would provide opportunities for increased hiking, biking, nature study, bird watching and fishing in and around the FPDA and Aeroject Canal. Additional recreation activities may also be supported (i.e., photography, environmental interpretation, picnicking, equestrian use and FWC managed hunts) by the project alternatives.

## **7.16 AESTHETICS**

Major aesthetic qualities to be considered include geology, topography, water and vegetation. Factors to be considered for evaluating quality include air and water pollution, pests, poor climate and unsightly adjacent areas.

Aesthetic resources are defined as those natural resources, landform, vegetation and man-made structures in the environment, which generate one or more sensory reactions and evaluations by the observer, particularly in regard to pleasurable response. These sensory reactions are traditionally categorized as visual, auditory and olfactory responses; more simply: sight, sound and smell. The visual sense is so predominant in the observer's reaction and evaluation that aesthetic resources, for the purpose of this section, will be referred to as visual resources. The other sensory stimulants, sound and smell, should be dealt with to the extent their presence is perceivable (Engineering Regulation [ER] 1105-2-100, *Appendix C*).

It is national policy that aesthetic resources be protected along with other natural resources. Current planning guidance specifies that the federal objective of water and related resources planning is to contribute to NED consistent with protecting the nation's environment. The USACE established a number of environmental goals, including: (1) preservation of unique and important aesthetic values; and, (2) restoration and maintenance of the natural and man-made environment in terms of variety, beauty, and other measures of quality. However, in meeting these goals, a standard of reasonableness must be applied in defining the appropriate level of expenditures for aesthetic quality at Civil Works projects. Current budgetary constraints and the intense competition for federal funds dictate that a greater level of discipline be applied in meeting the USACE's responsibilities to harmoniously blend projects with the surrounding environment while avoiding excessive expenditures (ER 1105-2-100, *Appendix C*).

All aesthetic measures must be designed so that they are fully compatible with the project purpose and in no way compromise the safety, integrity or function of the project. For example, it may be appropriate to screen a floodwall with vegetative plantings but it would be inappropriate to plant trees directly on a levee that might endanger its structural integrity or diminish its hydraulic characteristics (ER 1105-2-100, *Appendix C*).

#### **7.16.1 No Action Alternative**

With an anticipated increase in urbanization, changes in the project area are expected to reflect population growth. Aesthetically, there will be more high rises, roads and infrastructure associated with development and less open land.

#### **7.16.2 Alternatives 1C, 1D, 2D Short, 2D Long, 3D, and 6D**

Restoration of the south Florida ecosystem is expected to result in a healthier environment that would support vigorous plant communities, larger fish and aquatic animal populations, large numbers of wading birds, alligators, and sustainable populations of wide-ranging mammals, in a natural setting, in perpetuity. Viewing wildlife, wetlands and open, relatively pristine spaces are valued by people, as tourism statistics for south Florida would seem to support. In the short-term, the anticipated increase in native animals and native plants alone may not appreciably impact aesthetics to the casual observer. In fact, to the casual observer, the Everglades may already meet those criteria, as it is already a wilderness of fairly pristine character. In the long-term, however, with the implementation of the CERP wading bird communities are expected to increase dramatically, offering the public memorable viewing experiences that have not been seen for decades. While implementation of the C-111 SC Western project itself may not improve aesthetics, it is needed to ensure that a truly healthy and aesthetically pleasing ecosystem will exist in perpetuity.

### **7.17 SOCIO-ECONOMIC CONDITIONS: POPULATION**

Current statistics demonstrate that countywide, Miami-Dade is characterized by a slower population growth rate than the rest of the State, but a larger population growth than the nation as a whole. However, for lands within and adjacent to Miami-Dade County's UDB in the C-111 SC Western project study area, growth rates are projected to be much higher.

Miami-Dade County had a 2000 census population of 2,253,362 persons. The population of this county had relatively modest increase of 16.3 percent from 1990 to 2000, although it should be noted that Hurricane Andrew in 1992 had a significant impact on population growth during this time period because so many people moved out of the county. The population of Florida and the United States increased 23.5 percent and 13.1 percent respectfully during the same period. The state of Florida added over three million persons from 1990 to 2000, ranking third in the nation in numerical change.

Population in Miami-Dade is expected to increase by almost 1.5 million people from 2000 to 2050. Due to this anticipated population growth, the county is expected to remain the most populated county in Florida. The dense urban area of the Lower East Coast of Florida has contributed to development pressure and population increases in Miami-Dade County. Miami-Dade County is expected to grow faster than the national trends until at least 2050. Conversion of agricultural and other unimproved lands in southern Miami-Dade County including large areas within the C-111 SC Western project study area will continue to be fueled in significant part by this population growth.

#### **7.17.1 No Action Alternative**

With an anticipated increase in urbanization, changes in the project area are expected to reflect population growth

#### **7.17.2 Alternatives 1C, 1D, 2D Short, 2D Long, 3D, and 6D**

The implementation of the C-111 SC Western project will not significantly affect the population of the study area. The project will not create new water for consumption and the developable lands that are being utilized are geographically and spatially limited. Any impacts to the population as a result of the project will be statistically insignificant.

### **7.18 SOCIO-ECONOMIC CONDITIONS: WATER SUPPLY DEMANDS**

The Lower East Coast Region M&I water demand forecast is shown in the following table. Figures are derived from the University of Florida BEBR population and employment projections, and were collected for the 2000 Initial

CERP Update. The section of the Initial CERP Update that applies to the C-111 SC Western project study area is LECSA 3, which encompasses Miami-Dade and Monroe counties. Water demand projections estimate the LECSA 3 most likely population scenario, conservation-adjusted water use in 2050 at 505.6 mgd. LECSA 3 is expected to be using one third of the total water demanded in the nine-county Initial CERP Update Region. Due to the exceptionally small rate of growth projected between 2050 and 2060, it is not expected that 2060's water demands would be substantially higher than in 2050, after taking into account conservation measures.

The SFWMD requires the development of water conservation plans as a prerequisite for water utilities to obtain a water use permit. With the implementation of conservation plans, water demand should change. Most conservation plans incorporate passive water conservation measures that include increasing block rate structures, the required use of ultra-low flow water fixtures on new or renovated construction, restrictions on lawn watering, required use of rain sensors on automatic sprinkler systems, a leak detection program, and public education concerning water conservation measures.

With the increase in population and infrastructure, the demand for water will increase and the shortages and restrictions will become more prominent, leading to both economic and environmental damages. In the Lower East Coast Region groundwater is the predominant source of water for M&I uses. This trend is expected to continue in the future. The groundwater levels would continue to decrease, leading to increased shortages of water and increased salinity levels in wells in the study area. With more persons drawing water and less water available for recharge, migration of the underlying salt wedge leading to increased saltwater intrusion and shortages to wells and well fields would become more prevalent.

#### **7.18.1 No Action Alternative**

With the increase in population and infrastructure, the demand for water will increase and the shortages and restrictions will become more prominent, leading to both economic and environmental damages. In the Lower East Coast Region groundwater is the predominant source of water for M&I uses. This trend is expected to continue in the future. The groundwater levels would continue to decrease, leading to increased shortages of water and increased salinity levels in wells in the study area. With more persons drawing water and less water available for recharge, migration of the underlying salt wedge leading to increased saltwater intrusion and shortages to wells and well fields would become more prevalent.

### 7.18.2 Alternatives 1C, 1D, 2D Short, 2D Long, 3D, and 6D

Implementation of the C-111 SC Western project will operate as a redistribution of available water. The alternatives will utilize water that is being diverted from canals and currently discharged to tide. No impacts to upstream water users will be recorded, and the alternatives themselves will not demand new water or store additional water. Lands that are being utilized in the project footprint may become agricultural or urban development in the future and increase water demands as a result of the land use change.

### 7.19 HAZARDOUS, TOXIC AND RADIOACTIVE WASTE

#### 7.19.1 No Action Alternative

The site assessment work completed to date indicates the presence of no hazardous, toxic, or radioactive substance at concentrations exceeding, or approaching, federal or state regulatory levels for agricultural (commercial & industrial) land uses. The No Action Alternative would allow the project lands to continue to be farmed without consideration to the presence of residual agrochemicals.

#### 7.19.2 Alternatives 1C, 1D, 2D Short, 2D Long, and 3D

Alternatives 1C, 1D, 2D Short, 2D Long and 3D have the Frog Pond Detention Area (FPDA) as a primary component. As described in *Section 2.2* of this report, in *Appendix A*, and in *Annex B.2.2.3*, the Phase I/II Environmental Site Assessments (ESA) identified residual agrochemicals including barium, cadmium, chromium, copper, lead, zinc, 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, chlordane, and endosulfan in top soils within the footprint of the FPDA. All of these substances were present at concentrations well below Federal or State contaminant regulatory levels for the current agricultural (commercial & industrial) land use, however with concentrations that may pose risks to USFWS trust species. The construction of the proposed improvements under any of these alternatives require removal of all surficial soils as means of eliminating or reducing nuisance vegetation and to comply with engineering requirements. As such, the potential risks to USFWS trust species would be minimized and/or eliminated under each of these alternatives.

#### 7.19.3 Alternative 6D

No HTRW concerns have been identified related to Alternative 6D.

## **7.20 CULTURAL RESOURCES**

### **7.20.1 No Action Alternative**

The No Action plan offers little or no protection without further investigation, while the implementation of the C-111 SC Western project would include a conservation plan, thus providing some level of protection to cultural resources.

### **7.20.2 Alternatives 1C, 1D, 2D Short, 2D Long, 3D, and 6D**

The area of potential effect to cultural resources is essentially the same for Alternative 1D, Alternative 2D Short, Alternative 2D Long, Alternative 3D, and Alternative 6D. Though spread over a large area, the area of potential effect for all the alternatives is mostly confined to the Frog Pond Detention Areas and along existing canals between the Everglades National Park and L-31E. Although groundwater levels are expected to rise in the area of potential effect, surface water levels are not expected to change significantly and therefore, should not impact any cultural resources in the area.

A Phase I cultural resources survey was conducted in the area of potential effect. The survey identified a single historic resource (8DA11433), a limestone road likely constructed in the 1930s. It is not considered eligible for the National Register of Historic Places. With the concurrence of the State Historic Preservation Officer, the USACE has determined that the planned undertaking will have no effect on any significant cultural resources.

## **7.21 AIR QUALITY**

### **7.21.1 No Action Alternative**

Air quality between the present and 2050 is not expected to change significantly from existing conditions. Atmospheric contribution of mercury to the area would continue to decrease as existing controls on major mercury sources are fully implemented. Future, more restrictive regulations on mercury emissions from coal-fired power plants would likely continue the trend for reduced atmospheric contributions of mercury to the C-111 SC Western project area. This alternative would have no direct impact on greenhouse emissions and climate change.

### **7.21.2 Alternatives 1C, 1D, 2D Short, 2D Long, 3D, and 6D**

Construction activities associated with implementing Alternatives 1D, 2D Short, 2D Long, 3D, or 6D would temporarily increase dust within the proposed C-111 SC Western project area. BMPs to control dust would be implemented during construction. Implementing any of the alternatives evaluated is not expected to permanently affect air quality.

Alternatives 1D, 2DShort, 2DLong, and 3D would have a limited impact on greenhouse emissions and climate change as a result of the use of diesel engine driven pump stations. To pump the approximate average 80,000 ac-ft/yr of water at the Frog Pond Detention Area Pond or the Aerojet feature, approximately 85,000 gallons of diesel fuel would be required per year. This is the equivalent amount of diesel fuel that is required to operate 3 diesel tractor-trailers trucks for 1 year assuming 6 miles per gallon fuel efficiency and 150,000 miles driven per year for each of the trucks. These alternatives would contribute roughly equally to green house gas emissions and global climate change. Alternative 6D would make short-term contributions to green house gas emissions as related to the installation of its cutoff wall.

## **7.22 NOISE**

### **7.22.1 No Action Alternative**

Within the major natural areas of south Florida, external sources of noise are limited and of low occurrence. As additional areas are developed within designated growth boundaries around cities, noise from general traffic, construction, and other vehicles would be expected to increase modestly between the present and 2050.

### **7.22.2 Alternatives 1C, 1D, 2D Short, 2D Long, 3D, and 6D**

Noise impacts associated with Alternatives 1D, 2D Short, 2D Long, or 6D would not permanently increase over what presently exists within the project area. Temporary increases in noise levels would be expected during construction of any of the alternatives; however, this would be limited to the immediate area of construction.

## **7.23 UNAVOIDABLE ADVERSE IMPACTS**

### **7.23.1 Land Use**

Existing production of ornamental trees, nursery crops, and commodity row crops (i.e., peanuts, corn, citrus) would be permanently altered in areas subject to freshwater rehydration and increased water levels potentially unsuitable for agricultural requirements, specifically in the Frog Pond area.

### **7.23.2 Wetlands**

The study area consists primarily of mixed open land with agriculture, degraded wetlands and fallow fields. The wetlands are of low to moderate quality with limited function and value due to their reduced hydroperiod, infestation by exotic plant species, and location in the landscape (i.e., separation from other habitats and corridors). Implementation of the C-111 SC Western project would

permanently alter approximately 104 acres of wetlands by constructing and excavating project features. The loss of wetlands would be offset by restoring and rehydrating approximately 4,015 acres of freshwater and coastal wetlands. Damage to adjacent wetlands during construction will be limited by protections put in place as required by the environmental resource permits obtained prior to construction.

### **7.23.3 Water Quality**

Temporary increases in turbidity of local waters within allowable limits are expected during construction. The environmental resource permits issued by the FDEP and/or Army Corps that authorize the construction of the project features specify the turbidity and erosion control measures to be used during construction. Compliance with these standards is routinely confirmed by the FDEP.

### **7.23.4 Air Quality**

Fugitive dust from vehicular traffic and earth moving during construction will be unavoidable but insignificant overall.

### **7.23.5 Soils**

The conversion of farmland to rehydrated wetlands is not anticipated to be significant and irretrievable.

## **7.24 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES**

Construction of the proposed project will include features considered permanent, which may be deemed irreversible. This would include the installation/construction of pump stations, flow-ways, and berms. Resources committed would include state and federal funding to purchase lands (project lands have already been acquired with state and federal funds) and labor, energy and project materials to build, operate, and maintain the project.

## **7.25 CUMULATIVE EFFECTS**

Cumulative impact is the “impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions (40 CFR 1508.7).”

The C-111 SC Western project features are designed to enhance or restore wetland habitat functions by distributing freshwater flows through Taylor Slough into freshwater wetlands and downstream estuaries adjoining Florida

Bay to provide a more natural and historic overland flow through existing coastal wetlands. This project along with other CERP projects would cause some adverse consequences to agricultural land use in the Frog Pond area, permanently removing existing acres from agricultural production. These impacts may be felt locally and/or regionally as the economic base derived from agriculture is incrementally reduced relative to other sectors of the economy.

With the construction of pump stations, flow-ways, berms, and backfilling canals, there will be some loss of wetlands within the project site. Most of the existing wetlands have been impacted by surrounding agricultural activities, including reduced hydroperiods, ditching, and exotic plant species infestation. Much of these relatively low-functioning wetlands would ultimately be restored through redistribution of freshwater flows thus allowing for an overall higher wetland functional capacity. The project benefits to the natural system, which includes freshwater wetlands; coastal wetlands; the estuarine system-consisting primarily of high value mangrove wetlands, coastal marshes, tidal flats, and the nearshore area, would be significantly greater than the localized wetland loss.

Additionally, the restoration of historic drainage and inundation periods will also enhance the wetland habitat available to several federal and/or state listed plant and animal species.

#### **7.26 RELATIONSHIP BETWEEN SHORT-TERM USE AND LONG-TERM PRODUCTIVITY**

While regional conditions will improve, short-term or localized problems will undoubtedly occur. Although overall restoration of the Everglades ecosystem is expected to improve habitat for nesting wading birds regionally over time, the transition period might adversely affect regional wading bird populations. Proper sequencing of project features should mitigate impacts to existing wildlife resources expected to be impacted by restoration activities within their vicinity. Further assessment and monitoring will be critical to recovery of ecosystem attributes and maintaining a viable fish and wildlife population during the implementation of CERP.

#### **7.27 COMPATIBILITY WITH FEDERAL, STATE, AND LOCAL OBJECTIVES**

The proposed action is consistent with the overall goals and objectives of the CERP. It is expected that the proposed action will be consistent with federal, state, and local plans and objectives.

SECTION 8  
PLAN IMPLEMENTATION

## 8.0 PLAN IMPLEMENTATION

### 8.1 DIVISION OF IMPLEMENTATION RESPONSIBILITIES

The C-111 Spreader Canal Western Project is not being implemented as one of the initial CERP projects authorized under Section 601(b)(2)(C)(x) of the Water Resources Development Act of 2000 (WRDA 2000), rather it is being submitted to Congress for new specific authorization under Section 601(d). As currently envisioned, the SFWMD proposes to initiate construction on the C-111 SC Western Project features as part of the State's Expedited Construction effort prior to implementation of the Federal Project. The USACE is proceeding with two separate and independent but related actions: the planning evaluation of the Federal Project and the regulatory evaluation of the SFWMD's applications for a Section 404 (Clean Water Act) permit for certain activities needed to construct the proposed project, both of which are described in this PIR/EIS. The State's expedited construction of the C-111 SC Western Project is consistent with the recommended plan in this document. The purposes of the federal recommended plan identified in this PIR and the State's expedited construction project are consistent. A separate Regulatory EIS was published for Regulatory Division's NEPA evaluation of the SFWMD's proposed expedited construction project.

#### 8.1.1 Schedule

Once the public review period of the Final PIR/EIS is complete and comments are addressed the ROD will be signed and a fully executed Project Partnership Agreement (PPA) will follow. The Government and the SFWMD executed a pre-partnership credit agreement on August 13, 2009. A separate ROD on the Section 404 permit application was signed by the Jacksonville District Commander for the SFWMD's proposed 404 permit action on October 8, 2009. SFWMD completed design of the recommended proposed in the Final PIR/EIS and began construction in January 2010. In accordance with Federal law, the Assistant Secretary of the Army cannot consider approval of credit for the SFWMD's construction work until the recommended Project is authorized, funds are appropriated by Congress, and a PPA is executed.

#### 8.1.2 Preconstruction Engineering and Design

Detailed design of the C-111 SC Western project is currently being conducted by the SFWMD with coordination and review by the USACE. All detailed design and construction will be coordinated with the USACE. Crediting for construction work performed by the SFWMD will be subject to Project authorization and adherence to Federal standards, laws, and regulations. Lands, easements, right-of-ways, and relocations (LERRs) will be the responsibility of the SFWMD.

### 8.1.3 Operational Testing and Monitoring Period

As defined in the CERP Master Agreement, the term “Operational Testing and Monitoring Period” (OTMP) shall mean a reasonable, limited period of time within the period of construction, after physical construction has been completed, during which the authorized CERP Project or a functional portion of the authorized CERP Project is operated, tested and monitored to verify that the constructed features perform as designed, and to allow for any adjustments to such features as may be necessary so that such features perform as designed.

The CERP Master Agreement requires, when applicable, four criteria to be met to consider the Project, or a functional portion of the Project, operational and therefore ready to be turned over to the Non-Federal Sponsor for operation, maintenance, repair, replacement, and rehabilitation (OMRR&R). The OTMP is one of the four criteria.

In accordance with the CERP Master Agreement, the following criteria will be used to determine when a project is “operational”:

1. that construction of the authorized CERP Project or a functional portion of the authorized CERP Project is physically complete;
2. that the authorized CERP Project or a functional portion of the authorized CERP Project has completed an Operational Testing and Monitoring Period, where applicable;
3. that the features of the authorized CERP Project or functional portion of the authorized CERP Project:
  - i. meet applicable design and construction standards; and
  - ii. as supported by the results of an applicable Operational Testing and Monitoring Period, operate as designed and in accordance with applicable permit conditions and applicable operating manuals; and
4. that the Parties have completed and approved in writing the applicable System Operating Manual, Project Operating Manual, and MRR&R Manuals, final as-built drawings have been provided, Written Notices of Acceptance of Completed Work have been finalized and provided to the Non-Federal Sponsor, unless the Parties otherwise agree in writing that the Non-Federal Sponsor shall initiate OMRR&R based on interim manuals approved by the Parties.

The recommended plan features are primarily intended to improve the quantity, timing, and distribution of water delivered to Florida Bay via Taylor Slough. The features of the recommended plan which will require operational testing

and monitoring include a 590-acre above-ground reservoir with a 225 cubic feet per second (cfs) pump station (S-200), the Aerojet Canal with a 225 cfs pump station (S-199), an operable structure in the lower C-111 canal (S-198), a plug at S-20A, and ten plugs in the C-110 canal.

Prior to initiating the OTMP, each major operational component will undergo a short period of testing and commissioning. During this period, functional performance tests will be conducted on all pumps, reduction gears, diesel engines, control systems and ancillary equipment. Tests will replicate all modes of operation and will verify all other relevant contract requirements. Following the testing and commissioning, operational testing and monitoring will be conducted for one full wet season (i.e. June 1<sup>st</sup> to November 30<sup>th</sup>). If the OTMP begins after the start of a wet season, the OTMP should be extended as needed to encompass a full wet season. Beginning the OTMP prior to the start of a wet season, if needed, will allow continuity between the construction contractor and the identification of any necessary services identified by the Federal Government and Non-Federal Sponsor. Contractor services to be provided during the OTMP will include, but will not be limited to, the following: answering questions on equipment operation; contacting the appropriate vendor/manufacture for response or site visits; arranging and officiating supplemental owner training sessions; assisting in resolution of functionality issues. The operational testing and monitoring period activities of the construction contractor will be separate from and supplemental to the warranty requirements of the contract. The Non-Federal Sponsor will be responsible for interim operations during the Operational Testing and Monitoring Period. During the OTMP the Federal Government and the Non-Federal Sponsor will work together closely to identify any features which are not operating as designed. Any features which are not operating as designed will be identified in writing to the District Engineer and the Non-Federal Sponsor. At the conclusion of the OTMP, the District Engineer and the Non-Federal Sponsor will make a determination as to whether the Project is “operational” as defined in the CERP Master Agreement. After this determination, the Non-Federal Sponsor shall operate, maintain, repair, replace, and rehabilitate the Project.

#### 8.1.4 Implementation of Project Operations

A Project Operating Manual (POM) has been prepared and is included in *ANNEX D* of this PIR. As described in Section 5 of the July 2007 Revised Final Draft Programmatic Regulations, Development of the POM will involve an iterative process that will continue throughout the life of the Project. The Draft POM will include operating criteria based on the initial operating regime (IOR) and will generally discuss the transitions to operations during, construction, the Operational Testing and Monitoring Phase, and the Long-term Operations and Maintenance Phase. Refinements to the operating criteria will be made as more design details, data, operational experience and information is gained during

these phases. A Preliminary POM will be prepared and approved for the Operational Testing and Monitoring Phase. This will be followed by a Final POM that will be prepared and approved for the Long-term Operations and Maintenance phase. After the Final POM is completed and the Long-term Operations and Maintenance Phase is underway, the Final POM and the system operating manual (SOM) will continue to be revised based on additional scientific information, new CERP or non-CERP activities being implemented, and new CERP updates. The USACE and SFWMD will share in the responsibilities for conducting water management operations during the Operational Testing and Monitoring Period.

#### 8.1.5 Flood Plain Management and Flood Insurance Programs Compliance

The Non-Federal Sponsor agrees to participate in and comply with applicable Federal floodplain management and flood insurance programs consistent with its statutory authority.

Not less than once each year the Non-Federal Sponsor shall inform affected interest of the extent of protection afforded by the authorized CERP Project.

The Non-Federal Sponsor shall publicize flood plain information in the area concerned and shall provide this information to zoning and other regulatory agencies for their use in preventing unwise future development in the flood plain and in adopting such regulations as may be necessary to prevent unwise future development and to ensure compatibility with protection levels provided by the authorized CERP Project.

The Non-Federal Sponsor shall comply with Section 402 of WRDA 1986, as amended (33 U.S. C. 701b-12), which requires a non-Federal interest to have prepared, within one year after the date of signing a Project Partnership Agreement for the authorized CERP Project, a floodplain management plan. The plan shall be designed to reduce the impacts of future flood events in the Project area, including but not limited to, addressing those measures to be undertaken by non-Federal interests to preserve the level of flood protection provided by the authorized CERP Project. As required by Section 402, as amended, the non-Federal interest shall implement such plan not later than one year after completion of construction of the authorized CERP Project. The Non-Federal Sponsor shall provide an information copy of the plan to the Government upon its preparation.

The Non-Federal Sponsor shall prescribe and enforce regulation to prevent obstruction of or encroachment on the authorized CERP Project or on the lands, easements, and rights-of-way determined by the Government to be required for the construction, operation, maintenance, repair, replacement, and rehabilitation of the authorized CERP Project, that could reduce the level of

protection the authorized CERP Project affords, hinder operation or maintenance of the authorized CERP Project, or interfere with the authorized CERP Project's proper function.

## 8.2 COST SHARING

The total first cost of the Project, including the value of LERRs and preconstruction engineering and design costs will typically be shared 50/50 by the Federal government and the Non-Federal Sponsor. However, the Non-Federal Sponsor has expressed its intention to construct all or part of the ecosystem restoration features in the recommended plan. As such, the Non-Federal Sponsor would be contributing a share of costs for this project that is greater than 50 percent, and would carry over excess credits to another authorized CERP Project to balance the 50-50 cost share across all projects in the CERP in accordance with Section 601(e)(5)(C) of WRDA-2000. The Government and the SFWMD executed a Pre-Partnership Credit Agreement on August 13, 2009. This cost sharing breakdown is represented in *TABLE 8-1*.

Rules which determine how project responsibilities are shared are established in federal law and related implementing policies. Section 601 of WRDA 2000 authorizes in-kind cost sharing credit to the Non-Federal Sponsor for design and construction, and for the treatment of credit between projects to maintain a 50/50 cost share. Additionally, the balancing of Federal and Non-Federal contributions will be governed by the CERP Master Agreement. Section 601(e)(5)(B) of the WRDA 2000 authorizes the Secretary of the Army to provide credit to the Non-Federal sponsor for work completed by it during the period of construction pursuant to a Project Partnership Agreement (PPA) and a determination by the Secretary that the work is integral to the CERP. As part of its initiative for early implementation of certain CERP projects, the Non-Federal sponsor has stated that it will construct the C-111 SC Western Project consistent with this report, in advance of Congressional authorization and the signing of a PPA. Under the authority of Section 6004 of WRDA 2007, the Non-Federal sponsor, on August 13, 2009, executed the required pre-partnership credit agreement (PPCA) to preserve its opportunity for credit for in-kind work completed in advance of execution of a PPA. The Non-Federal sponsor is exploring alternative project delivery methods to expedite implementation of the Project through the State expedited program. Such delivery methods may include public-private partnerships in which the Non-Federal sponsor contracts with a private or not-for-profit entity for services that may include designing, building, operating or financing these components.

**TABLE 8-1: COST SHARE FOR THE C-111 SPREADER CANAL WESTERN FEATURES PROJECT - RECOMMENDED PLAN**  
(FY '11 PRICE LEVELS ROUNDED TO THE NEAREST \$1,000)

Item	Federal Cost	Non-Federal Cost	Total
<b>Ecosystem Restoration (ER)</b>			
PED <sup>1</sup>	\$ 10,512,500	\$ 10,129,500	\$ 20,642,000
Construction Management	\$ 3,745,500	\$ 3,745,500	\$ 7,491,000
LER&R	\$ 623,000	\$ 67,059,000	\$ 67,682,000
<u>Ecosystem Restoration<sup>2</sup></u>	<u>\$ 66,053,000</u>	<u>\$ 0</u>	<u>\$ 66,053,000</u>
Subtotal	\$ 80,934,000	\$ 80,934,000	\$ 161,868,000
ER Subtotal	\$ 80,934,000	\$ 80,934,000	\$ 161,868,000
<b>Recreation (ER)</b>			
PED <sup>3</sup>	\$ -	\$ 43,000	\$ 43,000
<u>Recreation</u>	<u>\$ 128,000</u>	<u>\$ 85,000</u>	<u>\$ 213,000</u>
Subtotal	\$ 128,000	\$ 128,000	\$ 256,000
Recreation Subtotal	\$ 128,000	\$ 128,000	\$ 256,000
<b>Total Project Cost</b>	<b>\$ 81,062,000</b>	<b>\$ 81,062,000</b>	<b>\$ 162,124,000</b>
<b>Associated Annual Costs</b>			
OMRR&R (non-recreation)	\$ 601,000	\$ 601,000	\$ 1,201,000
OMRR&R (recreation)	\$ -	\$ 25,000	\$ 25,000
OMRR&R (monitoring) <sup>4</sup>	\$ 133,500	\$ 133,500	\$ 267,000

<sup>1</sup>PED estimates for non-recreation components are derived directly from the cost estimating appendix. PED of the Federal Government includes development of the PIR.

<sup>2</sup>The ecosystem restoration construction cost and PED cost are not detailed as being shared equally due to the non-Federal Sponsor's land costs. The Federal shares were changed to bring the total project cost to a 50/50 share basis.

<sup>3</sup>PED is estimated based on 20% of the construction costs and is allocated 100% to the NFS as they are responsible for P&S development.

<sup>4</sup>OMRR&R costs for monitoring include \$267,000 for hydrometeorological, water quality, ecological, endangered species, and vegetation management monitoring that occurs after construction and operational testing and monitoring completion.

Note: Total costs shown are consistent with costs shown through out the report. Due to rounding to the nearest \$1,000, numbers may not total correctly.

### 8.2.1 Non-Federal Sponsor Cost Contributions

The Non-Federal Sponsor will be constructing the recommended plan through its state expedited program, which means that it will be expending funds prior to Congress authorizing the Project and appropriating funds for it. Therefore, it is necessary to detail the estimated financial outlays of the SFWMD for planning, engineering, design, lands, construction, and construction management. It is

estimated that the SFWMD will expend \$10,129,500 for planning, engineering, and design (PED). Its estimated costs for lands are \$67,059,000. Construction management and construction are estimated to cost the SFWMD \$3,745,500 and \$66,053,000, respectively. It's also estimated that the SFWMD will spend \$6,584,000 for hydrometeorological, water quality, endangered species, ecological, and vegetation management monitoring after construction is completed. The estimated total financial outlay of the SFWMD for the C-111 Spreader Canal Western Project is \$153,571,000.

### 8.2.2 Cost Sharing of Construction and Land Costs for Restoration Features

Section 601 of the WRDA of 2000 requires the Non-Federal Sponsor to provide LERR.

The total first cost of the restoration features of the Project, including the value of LERR and preconstruction engineering and design costs, will be shared between the Federal government and the Non-Federal Sponsor under the CERP program as a whole. The Non-Federal Sponsor will provide cash or manage a portion of construction as necessary to meet its 50 percent share of the total first cost of the project to be balanced according to Section 601 of WRDA 2000.

The total first cost of the recreation features of the Project, including the value of LERR and pre-construction engineering and design costs, will be shared equally between the Federal government and the Non-Federal Sponsor under the CERP program as a whole. The Non-Federal Sponsor will provide cash or manage a portion of construction as necessary to meet its 50 percent share of the total first cost. The Non-Federal Sponsor will be responsible for 100 percent of the OMRR&R costs of the recreation features. The total recreation costs increase the total project costs by less than 10 percent. A detailed description of the recreation features of the Project is included in *APPENDIX H*.

As currently envisioned, detailed design of the ecosystem restoration features will be accomplished by SFWMD with coordination and review by USACE under the state expedited construction program. All project features will be designed in accordance with USACE regulations and standards. Construction activities for the State Expedited Construction project will be in accordance with the State Expedited Construction program and will be the responsibility of SFWMD. Crediting for work performed by SFWMD will be subject to project authorization and adherence to USACE design standards and regulations.

### 8.2.3 Cost Sharing of Monitoring

A project monitoring plan that includes hydrometeorological, water quality and regulatory compliance, and ecological monitoring; have been prepared and is included in Annex E of this PIR. The duration of monitoring for most

parameters is designed to not exceed five years. The duration of monitoring, and habitat creation, for the endangered Cape Sable Seaside Sparrow (CSSS) is assumed to not exceed ten years from the completion of construction. These efforts will be cost shared during the construction phase of the Project in accordance with Section 601(b)(2) of WRDA 2000. After construction the costs will become part of the Project's operation, maintenance, repair, replacement, and rehabilitation plan and cost-shared as described in the recommendations section of this report.

A Project Operating Manual (Annex D) has been developed for day-to-day use in water management for all foreseeable conditions affecting the C-111 Spreader Canal Western Project. This operating manual has been designed to assist operators in maximizing flows to Central Florida Bay via Taylor Slough, and improving hydroperiods within the Model Lands. Operational monitoring will be cost shared during the operation and maintenance phase of the Project.

System-wide monitoring will be performed as part of the CERP Monitoring Assessment Program implemented by RECOVER. Data collected as part of this monitoring program is critical to the overall success of CERP Projects. Funding for system-wide monitoring is provided by and for RECOVER; and is independent from project-level funding.

#### 8.2.4 Cost Sharing of Operations and Maintenance

Section 601(e)(4) of the WRDA 2000 specifies that the Operation, Maintenance, Repair, Replacement, and Rehabilitation (OMRR&R) of authorized projects of the CERP would be cost shared equally by the Federal government and the Non-Federal Sponsor. Consistent with the provision of section 601(e)(4) of the WRDA of 2000 and given the multi-objective nature of the features in this plan, it is appropriate for the OMRR&R associated with this plan to be shared equally between the Federal government and the Non-Federal Sponsor. OMRR&R costs associated with recreation features of the plan will be funded 100 percent by the non-Federal local sponsor.

Activities included in the OMRR&R costs are:

- Pump and facility maintenance which are per manufacturer's recommendations and schedules.
- Erosion control to make sure banks and areas around culverts and other structures are not compromised by weather, plant or animal forces.
- Mowing to maintain grass areas for a neat and clean appearance and also to make sure there are no other maintenance issues being hidden by high grass vegetation. Mowing also reduces the ability of woody plants to gain a foothold and lead to larger issues.

- All monitoring, required by permit, USFWS Incidental Take Statement, and/or needed to adaptively manage the Project.
- Invasive, exotic, native, and nuisance vegetation control. Vegetation control is done both to control underwater infestations and surface infestations. Invasive plants can prevent correct project function and can damage vital structural components if allowed to grow unchecked.
- Adaptive Management (AM) measures needed to ensure project benefits or avoid violating one or more project constraints.

#### 8.2.5 Section 902 Limitations

The C-111 Spreader Canal Western Project is requesting new authorization under Section 601(d) of the Water Resources Development Act of 2000 (WRDA 2000.) The C-111 Spreader Canal Project is currently authorized under Section 601(b)(2)(C) of the WRDA 2000, but due to the request for new authorization the 902 provisions described under Section 601(b)(1)(E) is no longer applicable and the Section 902 maximum cost will apply to the new authorization for the C-111 Spreader Canal Western Project. Although the PED and Construction activities and costs are going to be covered separately under the CERP Design Agreement and the C-111 Spreader Canal Western Project Partnership Agreement, the basis for the C-111 Western 902 maximum cost is the total first cost of \$162,124,000 presented in *TABLE 8-1* and *SECTION 10.0 RECOMMENDATIONS*, which includes PED, Construction, LERR, and construction-funded monitoring.

#### 8.2.6 Construction and Monitoring Schedule

The C-111 SC Western Project recommended plan is scheduled for construction under the State's expedited construction program in December 2009. The total length of the construction is currently estimated to take two years.

The project level monitoring proposed in Annex E of this report will be conducted as necessary and required throughout and after construction. The total timeframe for project level monitoring is 5 years and the estimated cost is \$4,316,000. The duration of monitoring, and habitat creation, for the endangered Cape Sable Seaside Sparrow (CSSS) is assumed to not exceed ten years from the completion of construction and is estimated to cost \$2,298,000. These efforts will be cost shared during the construction phase of the project in accordance with Section 601(b)(2) of WRDA 2000. After construction they will be shared as part of OMRR&R.

#### 8.2.7 Non-Federal Sponsor Work-In-Kind

The Non-Federal Sponsor may be provided in-kind credit for project related work as described in Section 601(e)(5)(B) of the Water Resources Development Act of

2000, as amended by Section 6004 of the Water Resources Development Act of 2007. The Secretary may provide credit, including in-kind credit, toward the non-Federal share for the reasonable cost of any work performed in connection with the study, pre-construction engineering and design, or construction that is necessary for the implementation of the Plan if:

- a. the work is defined in an agreement between the Secretary and the Non-Federal Sponsor providing for such credit;
- b. the agreement must prescribe the terms and conditions of the credit;
- c. the project must ultimately be authorized by Congress as a Federal project; and
- d. the Secretary must determine that the work performed by the Non-Federal Sponsor is integral to the Project.

Such credit would be applied toward the Non Federal sponsor's share of the costs associated with the implementation of the CERP as authorized by Section 601(e)(5)(C) of WRDA 2000, shall not include cash reimbursements, and shall be subject to: a) the authorization of the C-111 SC Western Project by law; b) a determination by the Secretary of the Army that the construction work completed under the PPCA is integral to the authorized CERP restoration project; c) a certification by the District Engineer that the costs are reasonable, allowable, necessary, auditable, and allocable; and d) a certification by the District Engineer that the activities have been implemented in accordance with USACE design and construction standards and applicable Federal and State laws. Also, per Section 601(e)(5)(E) of the Water Resources Development Act of 2000, in-kind credit is subject to audit by the Secretary.

### 8.3 PROJECT DESIGN

#### 8.3.1 Application of the Design Criteria Memorandums for Hazard Potential Classifications of Impoundments

USACE Engineering Regulation typically provides rules and policies that engineers must follow to correlate their design parameters and decisions for approval. USACE Engineering Manuals typically provide general guidance in formulations and procedures that can be followed to complete design efforts for typical projects. Therefore, these publications allow unique project factors to be considered to optimize designs on a case-by-case basis.

##### 8.3.1.1 General Codes and Standards Used

- CERP Guidance Memoranda

- SFWMD Design Memoranda
- SFWMD Engineering Design Standards for Water Resource Facilities, Design Guidelines (July 2007)
- Design Criteria Memoranda (DCMs)

### 8.3.1.2 Design Criteria Memorandum

Each DCM lists USACE, State of Florida, or literature references for all supporting data, procedures, and guidance that were used to complete the documentations(s).

- DCM-1 Hazard Potential Classification, September 12, 2005
- DCM-2 Wind and Precipitation Design Criteria for Freeboard, February 6, 2006
- DCM-3 Spillway Capacity and Reservoir Drawdown Criteria, February 3, 2006
- DCM-4 Minimum Dimensions of Dams and Embankments, August 9, 2005
- DCM-5 Major Pump Station Engineering Guidelines, March 2, 2007
- DCM-6 Geotechnical Seismic Evaluation of CERP Dam Foundations, May 16, 2005
- DCM-7 Procedure for Development of Opinion of Probable Construction Costs, October 25, 2007
- DCM-8 Vulnerability Protection Requirements in Progress
- DCM-9 Dam Safety Instrumentation and Monitoring for CERP Dams, June 15, 2007
- DCM-10 Construction Quality Assurance Procedures in Progress
- DCM-11 Dam Safety Program, June 18, 2007
- DCM-12 Value Engineering, in Progress

## 8.4 PROJECT OPERATIONS

### 8.4.1 Existing Operations

Existing system operations within the project area are based on the Interim Operation Plan (IOP). IOP is a set of alternative water management practices employed to protect the federally listed endangered CSSS. The operational component is a marsh-driven plan for management of the structural components. The net effect of the IOP operations is to lessen the quantity of water near CSSS Subpopulation A during the nesting season, and provide more water to the sparrow populations on the east side of ENP by routing water around ENP with usage of new temporary pumps to both maintain flood control levels in the canals, and allow seepage into Taylor Slough through the new detention ponds constructed under the C-111 South Dade Federal Project. In

addition, it contains rules to maintain flood protection for areas east of ENP. While IOP certainly affects the quantity and timing of water received in the C-111 Basin, because the C-111 SCWF “takes what is given”, it is not anticipated that the POM for the C-111 South Dade Federal Project will need to be revised to include changes recommended within MWD. The IOP will be reviewed and revised, as needed, to incorporate operational changes recommended within the Draft Project Operating Manual.

#### 8.4.2 Initial Operations

Initial project operations will consist of, unless otherwise noted, continuation of IOP operations. Existing structures will continue to be operated under the current IOP for the protection of the CSSS, until such time that these operations are superseded by the Everglades Restoration Transition Plan (ERTP) for the MWD and C-111 South Dade Projects. The proposed C-111 Spreader Canal Western Project will result in two new operable pump stations upstream of S-177 (S-200 and S-199), and a new structure (S-198) between S-18C and S-197. Both pump stations will be using water that would generally be discharged to tide. The detention areas and surrounding areas will be monitored to ensure that the operations of the new pump stations will not affect the critical habitat of the CSSS as determined by the U.S. Fish & Wildlife Service’s biological opinion.

*ANNEX D* (“Draft Project Operating Manual” contains additional detailed information on operations of all of the project structures.

#### 8.4.3 Future Operations

During a later timeframe, the Everglades Restoration Transition Plan (ERTP) for the MWD and C-111 South Dade Projects will establish a long-term operations plan for the C-111 Canal and MWD. The ERTP will specify the operations for the C-111 Canal and MWD projects components including conveyance between Water Conservation Area (WCA)-3A and 3B, seepage control on the east side of ENP, and elevated portions of Tamiami Trail between WCA-3B and ENP to restore more natural flows into ENP. Implementation of the ERTP could precipitate changes to the operations described within this DPOM, however the scope of those changes, if any, is impossible to determine at this point in time.

### 8.5 PROJECT ASSURANCES

The overarching objective of the Plan is the restoration, preservation, and protection of the South Florida ecosystem while providing for other water-related needs of the region, including water supply and flood protection. The Federal Government and the Non-Federal Sponsor are committed to the protection of the appropriate quantity, quality, timing, and distribution of water to ensure the

restoration, preservation, and protection of the natural system as defined in section 601 of WRDA 2000, for so long as the Project remains authorized. This quantity, quality, timing, and distribution of water shall meet applicable water quality standards and be consistent with the natural system restoration goals and purposes of CERP, as the Plan is defined in the Programmatic Regulations. The Non-Federal Sponsor will protect the water for the natural system by taking the following actions to achieve the overarching natural system objectives of the Plan:

1. Ensure, through appropriate and legally enforceable means under Florida law, that the quantity, quality, timing, and distribution of existing water that the Federal Government and the Non-Federal Sponsor have determined in this Project Implementation Report is available to the natural system, will be available at the time the Project Partnership Agreement for the Project is executed and will remain available for so long as the Project remains authorized.
- 2a. Prior to the execution of the Project Partnership Agreement, reserve or allocate for the natural system the necessary amount of water that will be made available by the Project that the Federal Government and the Non-Federal Sponsor have determined in this Project Implementation Report.
- 2b. After the Project Partnership Agreement is signed and the Project becomes operational, make such revisions under Florida law to this reservation or allocation of water that the Federal Government and the Non-Federal Sponsor determines, as a result of changed circumstances or new information, is necessary for the natural system.
3. For so long as the Project remains authorized, notify and consult with the Secretary of the Army should any revision in the reservation of water or other legally enforceable means of protecting water be proposed by the Non-Federal Sponsor, so that the Federal Government can assure itself that the changed reservation or legally enforceable means of protecting water conform with the Non-Federal Sponsor's commitments under paragraphs 1 and 2. Any change to a reservation or allocation of water made available by the Project shall require an amendment to the Project Partnership Agreement.

Federal law and regulations for implementing the CERP require that each PIR address certain assurances as part of the recommendation for project approval and subsequent implementation. This section of the PIR addresses the provisions set forth in Section 601(h) of the WRDA 2000 and the Programmatic Regulations for the CERP (33 CFR Part 385) for Savings Clause Requirements and Project-Specific Assurances.

The following subsections contain a description of the specific requirements from the WRDA 2000 and the CERP Programmatic Regulations as well as the methods and results of the analyses necessary to meet the statutory requirements.

#### 8.5.1 Level of Service for Flood Protection

In accordance with Section 601(h)(5) of the WRDA 2000, each PIR is required to include an analysis of the Project's impacts on levels of service for flood protection that existed on the date of enactment of the WRDA (December) 2000, and also an analysis to ensure flood protection is in accordance with applicable law. If a project is expected to result in an impact on the existing levels of service for flood protection, the PIR will modify operations or re-design the Project, consider further acquisitions and/or formulate other alternatives to address the potential impact. The analysis to determine if there would be impacts to existing levels of service for flood protection was conducted on a project-level scale. A system-wide analysis was not performed because the C-111 SC Western Project does not influence any operations of the C&SF Project due to its location at the terminus of the system. Water that flows into the project area flows south and is then discharged into Florida Bay. Therefore, it is assumed to produce no system-wide effects.

##### 8.5.1.1 Project-Level Analysis

The project-level analysis that was conducted indicated that the proposed project would have an adverse impact on the level of service for flood protection in the project area. One way to address significant and adverse effects on the level of service of flood protection due to CERP Implementation is to consider acquisition of affected property. The Real Estate Takings Analysis that was conducted for Alternative 2DS in Appendix D accounted for changes in hydrology that were significant enough to require land acquisition. The Real Estate Takings Analysis identified 776 acres of privately-owned lands that would be impacted as a result of the implementation of the proposed project. Total impacted lands, including the 776 acres identified above, were approximately 11,565 acres. As such, the local sponsor will provide the 11,565 acres of lands either in fee, perpetual flowage easements, or by supplemental agreements, and will be responsible for those real estate interests as a project cost. Section 6.9.2 and Appendix D of this PIR provide a more detailed discussion of land acquisition for the proposed project.

#### 8.5.2 Effects on Existing Legal Sources of Water

In accordance with Section 601(h)(5) of the WRDA 2000, each PIR includes a requirement to determine if existing legal sources of water are to be eliminated or transferred as a result of project implementation. If a project is expected to

result in an elimination or transfer of an existing legal source of water, the PIR shall include an implementation plan that ensures a new source of water of comparable quantity and quality is available to replace the source that is being transferred or eliminated. The analysis to determine if there is an elimination or transfer of existing legal sources was conducted on the project level scale. A system-wide analysis was not performed because the C-111 SC Western Project is located at or near the coastline, does not alter regional operations and only affects water deliveries to the southernmost canals in the Central and Southern Project or coastal structures. Therefore, it is assumed to produce no system-wide effects.

#### 8.5.2.1 Project Level Analysis

The Project results in no elimination or transfer of water from existing legal sources because canal flows and levels upstream of the Project, which are the southernmost canals and control structures in the C&SF Project, will not be affected by the Project. Therefore, no elimination or transfer of water from existing legal sources such as public utility wellfields, private wells or agricultural irrigation wells will occur.

Water that flows into Florida Bay through the canals may also be considered an existing legal source that maintains fish and wildlife. The project features, specifically the FPDA and Aerojet Canal, are designed to intercept some of this water from the C-111 Canal. The water will be used to create a hydraulic ridge that will block the drainage effects of the C-111 Canal on Taylor Slough in ENP. The water that is held in the FPDA and Aerojet Canal to create the hydraulic ridge will eventually infiltrate naturally into the ground, seeping back into the C-111 Canal which is the original source of the water. The water will then continue on its original path to Florida Bay. As such, no elimination or transfer of water from Florida Bay will occur as a result of the proposed project.

#### 8.5.3 Identification of Water Made Available for the Natural System, Water to be Reserved or Allocated for the Natural System, and Water for Other Water-Related Needs

Subsection 601(h)(4) of the WRDA 2000, entitled "Project-Specific Assurances", contains specific requirements for project implementation reports. The Assurances require a *"project implementation report to identify the appropriate quantity, timing, and distribution of water dedicated and managed for the natural system; and to identify the amount of water to be reserved or allocated for the natural system necessary to implement under State law."*

In addition to the Project-Specific Assurances requirements from the WRDA 2000, Section 385.35(b) of the Programmatic Regulations requires that each project implementation report identify the quantity, timing, and distribution of

water to be dedicated and managed for the natural system necessary to meet the restoration goals of CERP. This evaluation considers the availability of the Pre-CERP Baseline water and previously reserved water, and whether improvements in water quality are necessary. The existing conditions for this project do not include any previously reserved water within the project area.

Section 385.35(b) of the Programmatic Regulations also requires that procedures be developed for identifying water generated by CERP for use in the human environment and that the quantity, timing, and distribution of water for other water-related needs be identified in project implementation reports.

### 8.5.3.1 Identification of Water Made Available for the Natural System

Consistent with Section 385.36 of the Programmatic Regulations and the draft Guidance Memorandum 4, several model simulations were conducted and compared to identify the water for the natural system. The 10th, 50th and 90th percentile identified for the Existing Condition Baseline (ECB), which represents the total water available for the natural system, the Initial Operating Regime with the project in place, the IOR\_2DS, which represents the water directed towards C-111 Canal, and the difference between the ECB and IOR\_2DS, which represents the total water made available by the project for the natural system are displayed in *TABLE 8-2*. The total water available to be diverted by the C-111 SC Western Project ranges from about 775 cfs to 0 cfs. The portion diverted to either the Frog Pond Detention Area or the Aerojet Canal (ECB minus IOR\_2DS) is the surface water made available by the C-111 SC Western Project and ranges from 504 cfs (10<sup>th</sup> percentile) to 0 cfs (50<sup>th</sup> percentile). Water is not available at the median (50% percentile) or higher (90<sup>th</sup> percentile) or for the representative dry year, 1989.

TABLE 8-2: TOTAL WATER AND WATER DIVERTED BY THE PROJECT FOR THE NATURAL SYSTEM QUANTIFIED AT S-177 (CUBIC FEET/SECOND)

Percentile:	10th	50th	90th
1978 Total Water (ECB)	54	0	0
1978 Water Directed towards C-111 Canal (IOR_2DS)	0	0	0
1978 Total Water Made Available by Project, (ECB minus IOR_2DS)	54	0	0
1995 Total Water (ECB)	775	0	0
1995 Water Directed towards C-111 Canal (IOR_2DS)	271	0	0
1995 Total Water Made Available by Project (ECB minus IOR_2DS)	504	0	0

To capture increases in water made available for the natural system, three transects located in South Miami-Dade, quantify surface flows in the Existing Baseline Condition, ECB. These flows are compared to the Initial Operating Regime with the Project in place, IOR\_2DS, which represents the total water available. The difference between these conditions for each year simulated represent the water made available for the natural system by the Recommended Project. The 10th, 50th and 90th percentile identified for the IOR\_2DS, which represents the total water available, the ECB, the existing water, and the difference between the IOR\_2DS and ECB, which represents the total water made available by the Project for the natural system are displayed in **TABLE 8-3**. The surface water made available by the C-111 SC Western Project ranges from 25.6 cfs (10<sup>th</sup> percentile) to 0 cfs (90<sup>th</sup> percentile).

TABLE 8-3: TOTAL SURFACE WATER AND WATER MADE AVAILABLE BY THE PROJECT FOR THE NATURAL SYSTEM QUANTIFIED AT TRANSECTS TA-1, TA-2W AND TA-2E (CUBIC FEET/SECOND)

Percentile:	10 <sup>th</sup>			50 <sup>th</sup>			90 <sup>th</sup>		
	TA-1	TA-2w	TA-2e	TA-1	TA-2w	TA-2e	TA-1	TA-2w	TA-2e
1978 Total Water (IOR_2DS)	41.4	22.5	3.4	0.4	0.2	0.2	0.1	0	0
1978 Existing Water (ECB)	30.2	10.8	0.3	0.4	0.2	0.1	0.1	0	0
1978 Total Water Made Available by Project (IOR_2DS minus ECB)	11.2	11.7	3.1	0	0	0.1	0	0	0
1995 Total Water (IOR_2DS)	73.5	53.4	2.6	8.8	1.6	0.2	0.8	0.1	0
1995 Existing Water (ECB)	47.9	24.2	2.3	8.1	1	0.2	0.5	0.1	0
1995 Total Water Made Available by Project (IOR_2DS minus ECB)	25.6	29.2	0.3	0.7	0.6	0	0.3	0	0

### 8.5.3.2 Identification of Water to be Reserved or Allocated for the Natural System

The SFWMD will use its water reservation or allocation authority to protect the water made available by the Project for the natural system as required by section 601 of WRDA 2000. The SFWMD has elected to protect the existing water in the natural system that the Project Implementation Report identifies as necessary to achieve the benefits of the Project, using water reservation or allocation authority under Florida law. To this end, the South Florida Water

Management District will protect the existing water needed for the natural system as indicated in *TABLE 8-2* and *TABLE 8-3*.

### 8.5.3.3 Identification of Water Made Available for Other Water-Related Needs

All water made available by the proposed project is for the natural system in order to attain project benefits. The recommended project does not provide water for other water related needs of the region; therefore, no quantification was performed.

### 8.5.4 State and Federal Assurances

The overarching objective of the CERP (Plan) is the restoration, preservation, and protection of the south Florida ecosystem while providing for other water-related needs of the region, including water supply and flood protection. The federal government and the State of Florida are committed to the protection of the appropriate quantity, quality, and timing, and distribution of water to achieve and maintain the benefits to the natural system described in the Plan. As envisioned in WRDA 2000 and the Programmatic Regulation, each PIR will identify this appropriate quantity, quality, timing, and distribution of water for the natural system.

The following language sets forth these commitments:

The overarching objective of the Plan is the restoration, preservation, and protection of the south Florida ecosystem while providing for other water-related needs of the region, including water supply and flood protection. The federal government and the Non-Federal Sponsor are committed to the protection of the appropriate quantity, quality, timing, and distribution of water to ensure the restoration, preservation, and protection of the natural system as defined in WRDA 2000, for so long as the Project remains authorized. This quantity, quality, timing, and distribution of water shall meet applicable water quality standards and be consistent with the natural system restoration goals and purposes of CERP, as the Plan is defined in the programmatic regulations. The Non-Federal Sponsor will protect the water for the natural system by taking the following actions to achieve the overarching natural system objectives of the Plan:

The Non-Federal Sponsor shall execute under State law the reservation or allocation of water for the natural system as identified in the PIR for this authorized CERP Project as required by Sections 601(h)(4)(B)(ii) of WRDA 2000 and the Non-Federal Sponsor has provided information to the Government regarding such execution. In compliance with 33 CFR 385, the District Engineer has verified such reservation or allocation in writing. Any change to such reservation or allocation of water shall require an amendment to the PPA after

the District Engineer verifies in writing in compliance with 33 CFR 385 that the revised reservation or allocation continues to provide for an appropriate quantity, timing, and distribution of water dedicated and managed for the natural system after considering any changed circumstances or new information since completion of the PIR for the authorized CERP Project.

#### 8.6 PROJECT MONITORING PLAN

The Recommended Plan includes a Project Monitoring Plan to ensure proper operation of the Project, ensure compliance with existing laws and regulations, and evaluate project performance. Hydrometeorological monitoring will mainly deal with observations regarding project operations and the resulting water distribution and levels in the system. Water quality and Regulatory activities are also part of the Project Monitoring Plan. Water quality monitoring is required to fulfill obligations for the State Water Quality program. Ecological monitoring is recommended to be implemented beyond the scope of RECOVER's system-wide Monitoring and Assessment Plan efforts and would be incorporated into the adaptive management strategy for south Florida. The duration of the project-level monitoring parameters is designed to not exceed five consecutive years. These monitoring efforts will be cost shared during the construction phase of the Project in accordance with Section 601(b)(2) of WRDA 2000. All costs associated with the physical operation of the Project will be funded through O&M. The total estimated cost for monitoring and vegetation management to be funded during construction is \$7,640,000. The post construction cost, and annual O&M cost, are \$6,583,000 and \$267,000, respectively.

#### 8.7 COMPLIANCE WITH ENVIRONMENTAL LAWS STATUTES AND EXECUTIVE ORDERS

**SECTION 9.6** provides detailed information regarding environmental compliance activities. **TABLE 8-4** below provides a summary of compliance and coordination for environmental statutes and regulations.

**TABLE 8-4: ENVIRONMENTAL COMPLIANCE AND COORDINATION**

<b>Law, Regulation or Policy</b>	<b>Status*</b>	<b>Comments</b>	<b>Last Coordinated</b>	<b>Full Compliance Expected</b>
<b>Clean Air Act of 1972</b>	PC	PIR/EIS will be coordinated with public agencies. Air emissions permit may be required for large diesel pumps; normally applied for during PED phase.	C&SF Restudy 1999	Compliance with Section 176 of CAA will occur with the coordination and review of the PIR/EIS by EPA.
<b>Clean Water Act of 1972</b>	PC	404 (b) (1) Evaluation has been prepared (Annex B). For the C-111 SC Project; WQC will be required; (State permit); NPDES permit will be required (State delegation); water quality is expected to improve with project.	Informal coordination with FDEP through participation in PDT meetings.	Full compliance upon issuance of the WQC and NPDES permits by the state.
<b>National Environmental Policy Act of 1969</b>	PC	NOI published; scoping meetings held; no new issues have been identified; NOA for the draft PIR/EIS for C-111 SC Project was published in FR on 24 April.	NOI for C-111 SC on 16 May 2002; Scoping letter sent on 7 May 2002.	Full compliance upon coordination of the final PIR/EIS, public outreach activities completed and signing of the ROD.
<b>Fish and Wildlife Coordination Act of 1958</b>	PC	Funds transferred annually to FWS; PALs received; FWS and NMFS active team participants and have provided info on fish and wildlife elements on project.	Ongoing. FWS and NMFS have participated in PDT meetings and creation of FSM document. PALs received dated 16 Dec 02; 30 Sep 03; 12 Feb 04; 24 Mar 05 and 22 Nov 05. Final FWCA report completed and posted on August 4, 2009.	Full compliance with completion and posting of the final FWCA report by FWS on August 4, 2009, and by the NMFS after review of the final PIR/EIS.

<b>Endangered Species Act of 1973</b>	C	List of affected species has been confirmed. Coordination with both FWS and NMFS is ongoing.	Confirmation of threatened and endangered species by letter dated, 17 June 2008. NMFS consultation completed and concurrence obtained on August 6, 2009.	This Act is in full compliance. Adverse impacts to some nesting areas for the CSSS are anticipated. Conservation measures have been coordinated with FWS to minimize impacts and will be employed to protect other T&E species (e.g. West Indian manatee) during construction and operation of the project. Other endangered species not expected to be a major issue for this study. The FWS issued a BO August 25, 2009.
<b>Magnuson-Stevens Fishery Mgt Act</b>	C	Overall project is expected to benefit Essential Fish Habitat; NOAA will accept Draft EIS as the EFH assessment.	Informal coordination with NOAA representative at PDT meetings.	Full compliance was achieved after review of the draft PIR/EIS by NMFS. NMFS consultation completed and concurrence obtained on August 6, 2009.
<b>Fishery Conservation and Management Act</b>	C	The project is being coordinated with NMFS	Informal coordination with NOAA representative at PDT meetings	Full compliance after review of the final PIR/EIS by NMFS. NMFS consultation completed and concurrence obtained on

				August 6, 2009.
<b>Coastal Zone Management Act of 1972</b>	PC	Based on a review of the May 2002 scoping notice and comments provided by state reviewing agencies, the state has determined that, at this stage, the project is consistent with the Florida Coastal Management Program.	May 2002	Additional consistency review by the state will occur during coordination of the draft and final PIR/EIS. Full compliance will occur with issuance of the WQC by the state.
<b>Coastal Barrier Resources Act and Coastal Barrier Improvement Act</b>	NA	There are no designated coastal barrier resources in the project area that would be affected by this project. These Acts do not apply.		
<b>Marine Mammal Protection Act of 1972</b>	PC	The West Indian Manatee does occur near some of the project sites. Incorporation of the safeguards used to protect Threatened and Endangered species during construction and operation would protect any marine mammals in the area. Coordination with the FWS will continue as construction and operational guidelines are incorporated to avoid impacts to this species.	May 2002 and coordination through PDT meetings.	Full compliance after review of the final PIR/EIS by FWS.
<b>Marine Protection, Research and Sanctuaries Act</b>	NA	The term "dumping" as defined in the Act (3[33 U.S.C. 1402](f)) does not apply to this project. Therefore the MPRSA does not		

		apply.		
<b>Estuary Protection Act of 1968</b>	PC	It is anticipated that estuaries would be positively affected by this project.	May 2002 and coordination through PDT meetings.	Full compliance after review of the final PIR/EIS by NMFS.
<b>Anadromous Fish Conservation Act</b>	PC	Anadromous fish species would not likely be affected. The project is being coordinated with NMFS.	May 2002 and coordination through PDT meetings.	Full compliance after review of the final PIR/EIS by NMFS.
<b>Migratory Bird Treaty Act and Migratory Bird Conservation Act</b>	PC	No migratory birds would likely be affected by project activities.		Full compliance after review of the final PIR/EIS by FWS.
<b>Wild and Scenic River Act of 1968</b>	NA	No designated Wild and Scenic river reaches would be affected by project related activities.		
<b>Federal Water Project Recreation Act</b>	C	The principles of this Act (PL 89-72) have been fulfilled by complying with the recreation cost sharing criteria.		
<b>Submerged Lands Act of 1953</b>	PC	The project would eliminate point source freshwater discharges and provide freshwater overland flow that will ultimately benefit the ecological habitats that occur on submerged lands of the State of Florida. No construction is expected on submerged lands; therefore, full compliance is anticipated.		Full compliance by completion of final PIR/EIS.

<b>Rivers and Harbors Act of 1899</b>	NA	The proposed work would not obstruct navigable waters of the United States.		
<b>National Historic Preservation Act of 1966 and the Archeology and Historic Preservation Act</b>	C	SHPO coordination has been initiated; Phase I survey indicated some resources are present, but not eligible for National Register for Historic Places.	Consultation with the Florida State Historical Preservation Officer has determined no effect on any significant cultural resources.	This project is in full compliance with this Act.
<b>RCRA, CERCLA, TSCA, FIFRA</b>	C	On-site contaminants are below threshold levels requiring management as hazardous wastes for existing or proposed land uses.	Environmental Site Assessments, Ecological Risk Assessments, and Soil Management plans have been developed in consultation with FDEP and USFWS through the life of the project.	This project is in full compliance with applicable sections of these Acts.
<b>Farmland Protection Policy Act of 1981</b>	C	Consultation with NRCS has determined no Prime Farmland Soils are within the project area.		This project is in full compliance with this Act.
<b>Executive Order 11988 Floodplain Management</b>	PC	(Floodplain Development). The areas for proposed restoration in the project area are virtually all considered floodplain. The purpose of the E.O. is to discourage federally induced development in floodplains. Commitment of lands	Ongoing	Full compliance expected after completion of the final PIR/EIS

		to project restoration will preclude such development.		
<b>Executive Order 11990 Protection of Wetlands</b>	PC	(Wetlands protection) The areas proposed for restoration are a combination of freshwater and coastal wetlands. A net functional “lift” is expected.	Ongoing Habitat mapping and other analysis of wetlands.	Full compliance after final PIR/EIS.
<b>Executive Order 12898 Environmental Justice</b>	C	The team is in compliance for this phase of the study, as no minority or economically disadvantaged population clusters have been identified in the immediate southern Dade County region where the spreader canal features are proposed.	1999 Restudy	This project is in full compliance with this E.O.
<b>Executive Order 13089 Coral Reef Protection</b>	PC	This project is expected to provide overall benefits to hard bottom communities and coral reef resources.	May 2002 and coordination through PDT meetings.	Full compliance after review of the final PIR/EIS by NMFS.
<b>Executive Order 13112 Invasive Species</b>	PC	Project is expected to reduce the abundance and variety of invasive plant species in the project area.	Ongoing coordination with FWS and DERM.	Full compliance after final PIR/EIS.
<b>Executive Order 13186 Migratory Birds</b>	C	No migratory birds would be affected by project activities.	Ongoing coordination with FWS	The project is in compliance with this Executive Order.

\* C: Complies fully; PC: partial compliance due to plan development; NC: non-compliant; NA: not applicable.

Key:

CAA	Clean Air Act	NOI	Notice of Intent
CWA	Clean Water Act	NPDES	National Pollutant Discharge Elimination System
E.O.	Executive Order		Planning Aid Letter
FWCA	Fish and Wildlife Coordination Act	PALs	Resource Conservation and Recovery Act
MPRSA	Marine Protection, Research and Sanctuaries Act	RCRA	State Historic Preservation Officer
NMFS	National Marine Fisheries Service	SHPO	

## 8.8 COMPLIANCE WITH FLORIDA STATUTES

The State of Florida has enacted several laws pertaining to implementation of CERP projects. These include amendments to section 373.026 (8), F.S., which establishes a requirement for the SFWMD to submit a report for review and approval by the FDEP prior to formal submission of a request for authorization from Congress and prior to receiving an appropriation of state funds for construction and other implementation activities (except the purchase of lands from willing sellers); enactment of Section 373.1501, F.S., which establishes the intent of the Florida Legislature with respect to the CERP and the criteria for FDEP approval and the procedures to be followed by the SFWMD and FDEP for submitting and reviewing request for approval; the enactment of Section 373.1502, which establishes permitting requirements and a process for the submittal, review, and issuance of certain regulatory permits for CERP projects; and the enactment of Sections 373.470, and 373.472 F.S. establishing the "Save Our Everglades Trust Fund," funding and reporting requirements, and procedures for distributions from the trust fund. The SFWMD's report addressing the criteria for approval listed in Section 373.1501, F.S. is included in *ANNEX C*.

In addition to the above-described statutory requirements, other sections of Chapters 373 (Water Resources) and 403 (Environmental Control) of the F.S. include requirements that may apply to various aspects of CERP project planning and implementation. In particular, Chapter 403 and the administrative laws adopted in accordance with Chapters 373 and 403 contain the requirements for facilities that involve the discharge or potential discharge of pollutants to surface and ground waters and the discharge of air pollutants, including facilities regulated under the Federal Clean Water and Safe Drinking Water Acts and the Federal Clean Air Act. Based on the information contained in the PIR, the selected plan complies with the applicable provisions of F.S. A detailed explanation of how the Project complies with the applicable requirements for CERP projects contained in the F.S. can be found in *ANNEX C*.

### 8.8.1 Permits, Entitlements and Certifications

In as much as construction of the various project components is scheduled to begin in 2009, SFWMD will be responsible for obtaining permits issued by the Regulatory Division of the USACE under the authority of Section 404 (discharge of dredged or fill material into waters) of the Clean Water Act (CWA) and any corresponding permits required by the State of Florida in accordance with Chapters 373 and 403 of the F.S.

SFWMD will be responsible for obtaining the Section 401 (CWA) water quality certification or waiver of water quality certification, as appropriate, from the

State of Florida. Typically, water quality certification is obtained through the State of Florida's regulatory program established under the authority of Chapter 373, F.S. Section 402 National Pollutant Discharge Elimination System (NPDES) permits required under the CWA may be required for the construction (non-point source runoff) of project features. This program has been delegated by the EPA for implementation to the State of Florida (FDEP). NPDES permits for construction of project features undertaken by SFWMD prior to federal approval and authorization of the entire project will be the responsibility of SFWMD. At this time, a NPDES permit will not be required for the operation of any planned project components, as the project does not involve treatment or the discharge of pollutant.

Depending upon the schedule for obtaining federal review and approval of the Project, the USACE will obtain all other required permits and certifications.

#### 8.8.2 Compliance with applicable Water Quality Standards and Permitting Requirements

The selected plan will comply with water quality standards applicable to the Project and adjacent waters. The selected plan's features are located in and adjacent to waters designated as Class III by the State of Florida. In accordance with Florida Administrative Code (F.A.C.) Rule 62-302 (Surface Water Quality Standards), the use classification of Class III waters is "Recreation, Propagation, and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife." In addition to the minimum and general criteria for surface waters found in Section 62-302.500(1), there are numerous water quality criteria for specific parameters for Class III waters listed in Section 62-302.530, F.A.C.

By virtue of its proximity to Everglades National Park (ENP), the recommended plan's features are also located adjacent to a State designated Outstanding Florida Water (OFW). Designated OFWs have been deemed worthy of special protection because of their natural attributes, and are provided special protection, including anti-degradation, under Section 62-302.700, F.A.C.

Although the selected plan is not expected to affect most of the parameters listed in this rule, certain parameters (e.g., turbidity, certain metals, dissolved oxygen and nutrients) listed in the criteria may be affected by construction and operations activities.

In general, any short-term impacts to water quality associated with construction of the selected plan will be ameliorated by construction sequencing, BMPs for erosion and sedimentation control and monitoring during construction. Longer-term impacts to water quality associated with the operation of project features will be addressed through operational monitoring and adaptive management actions, if potentially adverse affects are observed or predicted.

Although the selected plan is expected to improve near shore salinities in Eastern Florida Bay, the Project is not anticipated to significantly impact (improve or decline) water quality in the study area. Although the Project involves new surface water discharges, to the FPDA, and Aerojet Canal, the source water (C-111E) is generally in compliance with state water quality standards. Although some ancillary water quality treatment may occur within the FPDA, and Aerojet Canal, it is important to note that neither feature has been designed, nor will they be operated, specifically for the improvement of water quality. Upon completion of construction and initiation of operations, water quality and hydrology will be monitored to determine whether project design and operational objectives are being achieved.

### 8.9 ENVIRONMENTAL COMMITMENTS

The USACE, the Non-Federal Sponsor (SFWMD), and contractors commit to avoiding, minimizing, or mitigating for adverse effects during construction activities by taking the following actions:

1. Employ BMPs with regard to erosion and turbidity control. Prior to construction, the construction team should examine all areas of proposed erosion/turbidity control in the field, and make adjustments to the plan specified in the plan control device as warranted by actual field conditions at the time of construction.
2. The contract specifications will prohibit the contractor from dumping oil, fuel, or hazardous wastes in the work area and will require that the contractor adopt safe and sanitary measures for the disposal of solid wastes. The contractor will be required to prepare a spill prevention plan.
3. Demolition debris would be transported to a landfill or otherwise disposed of in accordance with federal, state, and local requirements. Concrete or paving materials would be disposed of in accordance with federal, state, and local requirements.
4. Inform contractor personnel of the potential presence of threatened and endangered species in the project area, the need for precautionary measures and the ESA prohibition on taking listed species.
5. Any measures or restrictions resulting from *SECTION 7* consultation shall be implemented.
6. The USACE and the SFWMD agree to maintain an open and cooperative informal consultation process with the FWS and the FWC throughout the design, construction, and operation of this restoration project.
7. To protect cultural resources, conditions stipulated by the State Historic Preservation Office (SHPO) will be followed. Language will be included in construction contract specifications outlining the steps to be taken in the event that undiscovered historical properties or unmarked human burials are encountered. An informational training session, developed by a professional archaeologist, will be conducted for the contractor's personnel

to explain what kinds of archaeological/cultural materials might be encountered during construction of the impoundment, and the steps to be taken in the event these materials are encountered. A professional archaeologist will conduct periodic monitoring of the project area during ground disturbing activities to determine if activities are impacting unanticipated cultural resources.

8. As required under WRDA 2000, the USACE and SFWMD agree to operate the project in accordance with the operating manual that was developed for this project, and which has been included as Annex D. A monitoring plan, found in Annex E, has been developed in the light of the Projects potential effects level of service for flood protection
9. Compliance with the State of Florida's requirements for approval of CERP projects is also addressed in *ANNEX C*.

#### 8.10 VIEWS OF NON-FEDERAL SPONSOR

The Non-Federal Sponsor (SFWMD) supports the C-111 SC Western Project, and has initiated design and construction efforts through the State of Florida's Expedited Construction program. A formal letter of support was provided by SFWMD's Governing Board on November 16, 2009.

SECTION 9  
COORDINATION, PUBLIC VIEWS, AND COMMENTS

## 9.0 PROJECT COORDINATION

### 9.1 SUMMARY OF COORDINATION, PUBLIC VIEWS AND COMMENTS

This NEPA document is an integrated PIR and EIS. Early in project planning, a letter notifying interested parties, tribes, and federal and state agencies was mailed to scope for potential issues or project suggestions. Comments received were evaluated and incorporated into the project planning, as appropriate. Please see *APPENDIX E* for additional information on scoping and comments received.

#### 9.1.1 Cooperating Agencies

In accordance with regulations pertaining to the NEPA (Title 40 of the CFR, part 1501.6), the following agencies were formally invited to become a cooperating agency for an EIS on the C-111 SC Western project:

- US Environmental Protection Agency
- US Fish and Wildlife Service
- US National Marine Fisheries Service
- National Park Service
- Florida Fish and Wildlife Conservation Commission
- Florida Department of Environmental Protection
- US Geological Survey
- Miami-Dade Department of Environmental Resources Management

Thus far, the FWS has formally declined the invitation to become a cooperating agency, but has emphasized continued support for the project. Responses from other agencies have not been received at this time.

Though not officially accepting the invitation as cooperating agencies for the purposes of NEPA, the following state and federal agencies are members of the PDT and have contributed to the development of the PIR/EIS: FWS, NMFS, EPA, FDEP, NPS, and DERM. These agencies are considered to be partners in CERP projects.

See *APPENDIX E* for additional information.

#### 9.1.2 National Environmental Policy Act Public Meetings

Initial coordination began with the distribution of a scoping letter, dated May 7, 2002, announcing the project and requesting assistance in gathering information to help define issues and concerns to be addressed in a NEPA document. Subsequent to the scoping letter, a Project Management Plan (PMP) public workshop was held on May 22, 2002 at the Miami-Dade Agricultural

Center in Miami, Florida. The public workshop, advertised through newspapers, radio news releases and email notices, introduced the project's goals and objectives, and provided opportunities for the public to voice their concerns on an array of project issues. On May 16, 2002 a NOI to prepare an EIS was published in the Federal Register (FR Vol. 67, Number 95).

A number of subsequent meetings open to the public have been held to date. CERP policy is for advance notification of meetings to be posted on the CERP website and digital calendar. The meetings generally include updates and discussion by the PDT, followed by a public comment period. The following is a list of recent public meetings held to date.

Benefits Analysis Workshop	October 24-25, 2006
PDT Meeting	October 26, 2006
Modeling/Benefits Analysis Workshop	January 17-18, 2007
PDT Meeting	May 15, 2007
Benefits Analysis Workshop	June 4-6, 2007
Benefits Analysis Workshop	June 25, 2007
PDT Meeting	August 21, 2007
PDT Meeting	February 21, 2008
PDT Meeting	March 12, 2008
PDT Meeting	April 8, 2008
PDT Meeting	May 20, 2008
PDT Meeting	June 18, 2008
PDT Meeting	October 22, 2008

See *APPENDIX E* for a copy of the scoping letter and related public and agency comments.

## 9.2 PUBLIC INVOLVEMENT PROGRAM

The PDT is an interagency team consisting of state and federal agencies. In addition to the formal scoping process, overviews of the project, including a discussion of alternative screening and details of the Recommended Plan were presented to the Water Resources Advisory Commission (WRAC) in April 2008 and to the Working Group (South Florida Ecosystem Restoration Task Force) in September 2008.

## 9.3 INSTITUTIONAL INVOLVEMENT

This study focuses on the entire south Florida ecosystem and EC 1105-2-409, "Planning in a Collaborative Environment", was utilized to coordinate with other Federal and state agencies involved with restoration. The SFWMD is the cost share sponsor; however, many study partners were involved with the development of the project implementation report (PIR)/EIS including:

U.S. Environmental Protection Agency  
U.S. Fish and Wildlife Service  
U.S. National Marine Fisheries Service  
National Park Service  
Florida Fish and Wildlife Conservation Commission  
Florida Department of Environmental Protection  
U.S. Geological Survey  
Miami-Dade Department of Environmental Resources Management

These agencies are considered to be partners in Comprehensive Everglades Restoration Plan (CERP) projects.

#### 9.4 ADDITIONAL REQUIRED COORDINATION

Consultation with the Seminole Tribe of Florida and the Miccosukee Tribe of Indians was initiated through the scoping letter. Separate cover letters were also provided to each of the tribes along with a hard copy and electronic copy of the draft PIR/EIS. The C-111 Spreader Canal Western project has no features on tribal property, so no tribal laws are applicable. Additional consultation with the tribes regarding cultural resources is documented in *APPENDIX C*.

A final Project Implementation Report/Environmental Impact Statement disclosing all significant impacts has been prepared in accordance with (IAW) CEQ regulations. This final PIR/EIS will be made available for public review for a period of 30 days. Compliance with environmental laws is summarized in Section 9.6 below. The project is currently in compliance with all applicable laws. None of the coordination to date has indicated that the project will have compliance issues in implementing any of the proposed alternatives.

#### 9.5 PUBLIC VIEWS AND RESPONSES

In compliance with the NEPA, scoping was initiated in May 2002 for the C-111 Spreader Canal project. It was determined that an EIS would be necessary for this project, and a NEPA scoping letter dated 7 May 2002 was sent to Federal, state and local stakeholders, including those who had earlier expressed an interest in this project. Scoping comments were received, evaluated and incorporated into the project planning as appropriate. In addition, this PDT is comprised of an interagency team including the USEPA, SFWMD, NMFS, FWC, DERM, FDEP, ENP, and FWS. The comments are summarized below:

Initial public and agency comments received in response to a 16 May 2002 public notice of intent to prepare a Draft Integrated PIR and EIS focused on the amount of water required to achieve restoration goals in the Model Lands, Southern Glades, and Florida Bay. Although there was general support for the project and the potential for improved habitat to benefit fish and wildlife

resources, concerns included the quantity and quality of water available for the project; and the high degree of uncertainty associated with model predictions because the project area is more topographically heterogeneous than the model assumes for this region. Recommendations encouraged the expansion of the project in order to ensure Florida Bay receives the amount of freshwater required for restoration.

A number of subsequent meetings were held where stakeholders and representatives of non-governmental environmental organizations provided written comments and statements. The primary focus of their concerns centered on splitting the original plan, uncertainties about restoration opportunities in the Model Lands and Southern Glades, and the need to identify additional sources of water for delivery to Florida Bay, specifically in the dry season to sustain salinities conducive for estuarine biological and vegetative communities. One recommended component was the need to include storage features in the upstream communities, which is an important consideration for hydration during the dry season.

Additional concerns raised included topographic uncertainties inherent to all modeling outputs; a lack of confidence in the surface flows; the need to define long-term management options; detected levels of contaminants should be evaluated for potential risks; and the design of the project should incorporate polishing wetland components and should allow for maximum restoration to freshwater and coastal wetlands.

Similar issues, as well as new concerns, were expressed during the public and agency review of the C-111 Spreader Canal Western Project Draft PIR and EIS. Specific concerns included a request for further discussion on water quality benefits; the process for implementing adaptive management and control of invasive species; concerns that the restoration plan may not be as effective if operational protocol is restricted to the management of the CSSS; possible contamination impacts of the spoil material; assurances that any discharges from the project will meet the State's water quality standards; a rise in groundwater elevations could result in root zone flooding that will be detrimental to crops; flooding risk to private agricultural property; acquisition of privately owned lands impacted by the project; expansion of exotic and invasive species; salt intrusion to the aquifer; dry season salinity affects in Manatee Bay and Barnes Sound; water quality, pesticide and contaminants in the Frog Pond Detention Area; and the potential leaching of soil contaminants into surface water and groundwater within wetlands that could pose a long-term threat to natural resources and overall water quality.

Copies of public and agency comment letters are presented in Annex B (B.4 Pertinent Correspondence / Compliance Letters) of this report. In addition, a

summary of all comments and subsequent responses are contained in **TABLE B-2** of **ANNEX B** (B.4.2 - Public and Agency Comments and Responses on the Draft Report).

## 9.6 ENVIRONMENTAL COMPLIANCE

This section provides detailed information regarding environmental compliance activities.

### 9.6.1 Clean Air Act of 1972

The existing air quality within south Florida is considered good. Section 176 (c) of the Clean Air Act (CAA) requires that federal agencies assure that their activities are in conformance with the federally-approved CAA state implementation plans for geographical areas designated as “non-attainment” and “maintenance” areas under the CAA. This project is not located within a “non-attainment” area since there are none within the State of Florida. The only potential source of air pollution would be from pump station(s). Pursuant to rule 62-210.300(3)(a)(21)(b), operations staff will be required to determine if stations will be exempt from air permitting or if an air general permit will be required. This project has been and will continue to be coordinated with EPA for compliance with Section 309 of the Act. A Title V Source air permit application will be submitted to the Environmental Health and Engineering Section of the County's Department of Health prior to construction.

### 9.6.2 Clean Water Act of 1972

All State water quality standards will be met. A Section 404 (b)(1) evaluation has been prepared and is included in Annex B of the Final PIR/EIS. The Water Quality Certification (WQC) will be obtained by the project sponsor for most of the project features in the Frog Pond and Aerojet areas. The USACE may obtain WQC from the FDEP for features it constructs. Construction related water quality impacts will be addressed by obtaining the required NPDES permit from the FDEP prior to construction. The project is in compliance with this Act.

The WQC obtained from the FDEP include general and specific conditions that specify the protection of water quality and natural resources both during construction and during operation of the project features.

### 9.6.3 Coastal Zone Management Act of 1972

The State Clearinghouse provided comments in response to a scoping letter of March 2003, and indicated probable consistency. A federal consistency determination in accordance with 15 CFR 930 Subpart C is included in the Final

PIR/EIS. The consistency review, delegated to the State of Florida, was performed during the coordination of the draft PIR.

#### 9.6.4 National Environmental Policy Act of 1969

Initial coordination began with the distribution of a scoping letter, dated May 7, 2002, announcing the project and requesting assistance in gathering information to help define issues and concerns to be addressed in a NEPA document. Subsequent to the scoping letter, a PMP public workshop was held on May 22, 2002, at the Miami-Dade Agricultural Center in Miami, Florida. The public workshop, advertised through newspapers, radio news releases, and email notices, introduced the project's goals and objectives, and provided opportunities for the public to voice their concerns on an array of project issues. On May 16, 2002 a NOI to prepare an EIS was published in the Federal Register (FR Vol. 67, Number 95). The project is in compliance with the NEPA.

#### 9.6.5 Fish and Wildlife Coordination Act of 1958

The central objective of the FWCA is to allow for equal consideration of wildlife resources. Transfer funds have been made available to the FWS in order to participate in PDT meetings and workshops scheduled in conjunction with the USACE's planning, implementation, and evaluation process. Funding has been provided for the FWS to conduct surveys and investigations necessary to determine impacts of the C-111 SC Western project on wildlife resources and to make recommendations to the USACE on measures to prevent loss of or damage to wildlife resources. Recommendations for optimizing opportunities related to the conservation and enhancement of fish and wildlife resources have been provided through the submittal of PALs dated December 16, 2002, September 30, 2003, February 12, 2004, March 24, 2005, and November 22, 2005. A final Coordination Act Report (CAR) was submitted in July 2009. The final CAR is contained in Annex A of this report. In summary, the FWS supports the C-111 SC Western project and its potential to have wide-ranging beneficial effects on fish and wildlife resources. The FWS recognizes the probability of increased urban development and potential for further degradation of resources in a future without project scenario.

From the onset of the C-111 SC project, representatives from both agencies have been involved in the project planning, development and evaluation, with particular interests in effects to fish and wildlife resources and natural wildlife management areas. The project team continues to coordinate with FWS and FWC. This project is in full compliance with the Act.

### 9.6.6 Migratory Bird Treaty Act and Migratory Bird Conservation Act

No migratory birds would likely be affected by project activities. However, with the potential construction of reservoirs, and features designed to spread overland flow, as well as its location adjacent to natural areas, it is anticipated that migratory birds, especially wading birds, would benefit by additional foraging areas provided by the project. The project is in compliance with these Acts.

### 9.6.7 Endangered Species Act of 1973

In a letter dated December 16, 2003, the USACE initiated informal coordination with the FWS seeking a determination on the likelihood of adverse effects on a listed plant and animal species or their critical habitat within the C-111 SC Western project area. In accordance with *Section 7* of the EPA, as amended, the FWS responded in a letter dated February 12, 2004 stating that nine federally listed species and four threatened species are known to exist or could possibly exist in the general project area. The FWS recommended several actions to be taken by the USACE in determining an affect on those species through the eventual submittal of a Biological Assessment. More recent communication with the FWS (14 July 2008) suggests twelve endangered species, eight threatened, and one similarity of appearance species could possibly exist in the project area. The USACE continues to work with the FWS in gathering more information on endangered species in the project area and towards creating design modifications that may actually benefit the species. The Biological Opinion was received on August 25, 2009. Formal consultation has been completed and the project is in full compliance with the ESA.

### 9.6.8 Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act, 16USC 1801 et seq. PL 104-208 reflects the Secretary of Commerce and Fishery Management Council's authority and responsibilities for the protection of EFH. Federal agencies that fund, permit, or carry out activities that may adversely impact EFH are required to consult with the NMFS regarding the potential effects of their actions on EFH. In conformance with the 1996 amendment to the Act, the information provided in this PIR/EIS comprises the required EFH assessment and has been coordinated with NMFS.

This project falls within the jurisdiction of both the South Atlantic Fishery Management Council (SAFMC) and the Gulf of Mexico Fishery Management Council (GOMFMC). They are located in areas designated as EFH for coral, coral reef and live bottom habitat, red drum (*Sciaenops ocellatus*), shrimp, spiny lobster (*Panulirus argus*), other coastal migratory pelagic species and the snapper-grouper complex. Specifically, EFH in Florida Bay is comprised of

seagrasses, estuarine mangroves, intertidal flats, estuarine water column, live/hard bottoms, and coral reefs. Seagrasses occur in a broad band near the western and eastern shores of Florida Bay and surround a relatively large area of hard bottom. Seagrass areas have been designated as an EFH Area of Particular Concern for post-larval and juvenile shrimp, red drum, and juvenile gray snapper. Intertidal flats occur in a narrow band shoreward of the seagrasses, and estuarine mangroves occur as a shoreline fringe, particularly along the western edge of Florida Bay. Once estuarine, Florida Bay is now largely marine in character, although reduced salinities occur following major storms or extended periods of rainfall. Isolated coral patches occur on the hard bottom areas of the Bay, but coral reefs occur only seaward of the fringing keys outside of the Bay.

Consultation for the C-111 SC project was initiated in May 2002. The NMFS has been a participant of the C-111 SC Interagency Team (formally the PDT) and has indicated that beneficial effects to fish resources and EFH may occur as a result of this project. The NMFS requested an evaluation of potential impacts to living marine resources, including mangroves, seagrasses, live bottom communities, and the marine/estuarine water column that may be impacted by activities or operations of the project alternatives. The preparation of an EFH assessment is contained within the body of the Final PIR/EIS, and submitted to the NMFS for coordination. On 30 April 2009, the NMFS concurred that the project will have a net benefit on EFH and that the construction related impacts are upstream of EFH, therefore, further consultation is not required.

#### **9.6.9 Marine Mammal Protection Act of 1972**

The West Indian manatee does occur within the project area. Incorporation of the safeguards used to protect threatened or endangered species during construction and operation would protect any marine mammals in the area; therefore, it is not anticipated the project will result in take as defined by Marine Mammal Protection Act. Manatee protection is managed by the FWS. Coordination will continue with the FWS.

#### **9.6.10 Estuary Protection Act of 1968**

The C-111 SC Western project is designed to eliminate canal point source freshwater discharges to Florida Bay and re-route freshwater flows overland to the downstream estuaries. Freshwater flows will ultimately rehydrate the existing hyper-saline habitats and re-establish a salinity regime more suitable for the survivorship of estuarine communities. This project is anticipated to benefit coastal wetlands and associated estuarine habitats and is, therefore, in full compliance with the Act.

**9.6.11** Anadromous Fish Conservation

Anadromous fish species would not likely be affected. The project is being coordinated with NMFS; full compliance is anticipated after review of the final PIR/EIS by NMFS.

**9.6.12** Migratory Bird Treaty Act and Migratory Bird Conservation Act

No migratory birds would likely be affected by project activities. Full compliance is anticipated after review of the final PIR/EIS by FWS.

**9.6.13** Federal Water Project Recreation Act

The principles of this Act (PL 89-72) have been fulfilled by complying with the recreation cost sharing criteria.

**9.6.14** Submerged Lands Act of 1953

The project would eliminate point source freshwater discharges and provide freshwater overland flow that will ultimately benefit the ecological habitats that occur on submerged lands of the State of Florida. No construction is expected on submerged lands; therefore, full compliance is anticipated.

**9.6.15** National Historic Preservation Act of 1966 (As Amended) (PL 89-665, the Archeology and Historic Preservation Act (PL 93-291), and Executive Order 11593)

The USACE is reviewing information regarding historical properties that might be affected by the C-111 SC Western project, in compliance with Section 106 of the National Historic Preservation Act of 1966 (PL 89-665), as amended in 2006; its implementing regulations (36 CFR Part 800) and the Archaeological and Historic Preservation Act of 1974 (PL 93-291), as amended.

A review of the Florida Master Site Files indicated several known archaeological sites and the probability of unrecorded sites within the C-111 SC Western project area. A Phase I cultural resources survey was conducted in the APE. The survey identified a single historic resource (8DA11433), a limestone road likely constructed in the 1930s. It is not considered eligible for the National Register of Historic Places. With the concurrence of the State Historic Preservation Officer, the Corps has determined that the planned undertaking will have no effect on any significant cultural resources.

This determination has been made in compliance with Section 106 of the National Historic Preservation Act of 1966 (PL 89-665), as amended; its implementing regulations (36 CFR Part 800) and the Archaeological and Historic Preservation Act of 1974 (PL93-291), as amended.

If during project development, unanticipated discoveries are made, construction will stop and the Corps' archeologist, State Historic Preservation Officer, and consulting Tribes will be notified. If these unanticipated discoveries include human remains, this would also require notification of the state archeologist in compliance with Chapter 872.05, Florida Statutes, or the county medical examiner if the remains are less than 75 years old.

#### **9.6.16 Resource Conservation and Recovery Act of 1976 and other Federal Laws Governing Hazardous Waste**

This section acknowledges that several federal laws governing the management and control of hazardous materials and hazardous waste have been taken into consideration in the formulation of this project. Unlike NEPA and some other laws discussed above, federal hazardous waste laws do not require formal consultation, or permits to be issued by the other agencies unless threshold conditions are met.

There are two federal laws that primarily govern the management of hazardous substances and waste: the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or the Superfund law), and the Resource Conservation and Recovery Act (RCRA). CERCLA provides for the liability, compensation, cleanup, and emergency response for hazardous substances released into the environment and also the cleanup of inactive hazardous waste disposal sites. Although RCRA can deal with sites having historical contamination, it also regulates various aspects of ongoing commercial/industrial activities where hazardous materials are handled, and hazardous wastes are generated, treated, stored, or disposed. Engineering Regulation 1165-2-132 establishes policies and authorities regarding Hazardous, Toxic and Radioactive Waste (HTRW) in USACE Civil Works Projects, and is based on a CERCLA definition of "hazardous substance" that includes "hazardous wastes" regulated under RCRA.

Several databases have been created to track HTRW actions in accordance with the above laws. For this project a review of HTRW databases indicated that several landfills, CERCLA priority sites, are located north of the project area. The following additional databases were reviewed: toxic release inventory system, NPL, CERCLA sites, leaking underground storage tanks, large quantity generators, small quantity generators, underground storage tanks, treatment storage and disposal facilities and above ground storage tanks.

The C-111 SC Western project consists primarily of undeveloped or preserved areas, active agriculture, and former agriculture, all of which lie adjacent to agriculture and residential areas of Miami Dade County. Review of aerial photographs of the C-111 SC project area, over flight, and site investigations indicated that the probability of finding CERCLA and RCRA regulated materials

within the project area was low. Subsequently, soil sampling during Phase I and Phase II Environmental Site Assessments identified the presence of residual pesticide and metals contamination, but at low levels which did not exceed the threshold requiring management as hazardous waste.

Additional discussion regarding the presence or absence of site contamination can be found in *Section 2.12*, *Section 7.19*, and *Annex B.2.2.3* of this document. All indications are that the proposed project is in compliance with CERCLA, RCRA, and other federal laws governing hazardous waste.

#### **9.6.17** Farmland Protection Policy Act of 1981

Consultation with the NRCS, in a letter dated 10 December 2008, has determined that no Prime Farmland Soils are within the project area. The NRCS has further designated that the project area does not contain any Prime, Unique, Statewide, or Locally important farmland. This project, therefore, is in full compliance with this Act.

#### **9.6.18** E.O. 11988, Flood Plain Management

The project has been evaluated in accordance with this Executive Order. This project is in compliance.

#### **9.6.19** E.O. 11990, Protection of Wetlands

The areas proposed for restoration are a combination of freshwater and coastal wetlands. Habitat mapping and other analysis of wetlands have been conducted. As a result, a net functional “lift” to wetlands within and adjacent to the project is expected. This project is in compliance with the goals of this Executive Order.

#### **9.6.20** E.O. 12898, Environmental Justice

Executive Order 12898 requires the federal government to achieve environmental justice by identifying and addressing disproportionately high adverse effects of its activities on minority or low-income populations, and by involving potentially affected minorities in the public coordination process. The team is in compliance for this phase of the study, as no minority or economically disadvantaged population clusters have been identified in the immediate southern Dade County region where the spreader canal features are proposed. This project would not result in adverse human health or environmental effects. Stakeholder meetings with minority groups took place in 2003 to address concerns. The project is in compliance with the Executive Order.

**9.6.21** E.O. 13112, Invasive Species

The C-111 SC Western project is expected to reduce the abundance and variety of invasive plant species in the project area by restoring the natural hydrology. Restored hydroperiods, and the restoration of more natural sheet flow are changes that will benefit native vegetation to the detriment of exotic species. This project will not authorize, fund, or carry out any action that might spread or introduce invasive species. Therefore, this project will comply with the goals of this Executive Order.

**9.6.22** E.O. 13186, Migratory Birds

The project has been coordinated with the FWS concerning migratory birds. The project is expected to benefit migratory birds by improved habitat and increased availability of forage species (amphibians, fish, and aquatic invertebrates) for wading birds. This project is in compliance with this Executive Order.

SECTION 10  
RECOMMENDATIONS

## 10.0 DISTRICT ENGINEER'S RECOMMENDATION

The C-111 SC Western Project is not being implemented as one of the initial CERP Projects authorized under 601(b)(2)(C)(x) of the Water Resources Development Act of 2000, rather it is being submitted to Congress for new specific authorization under 601(d) of the Water Resources Development Act of 2000. This Project is essential to achieving restoration of the South Florida ecosystem and plays an integral role in meeting the CERP system-wide ecosystem restoration goals and objectives. Structural and operational changes will be implemented to improve the quantity, timing, and distribution (QTD) of water delivered to Florida Bay via Taylor Slough as well as improve hydroperiods within the wetlands of the Southern Glades and Model Lands. The water deliveries will be improved by the creation of a hydraulic ridge just east of the eastern edge of Everglades National Park. Hydroperiods and hydropatterns within the wetlands of the Southern Glades and Model Lands will be improved by the construction of a new water control structure in the lower C-111 Canal, increasing operational stage triggers at the existing S-20 structure, and installing earthen plugs in strategic sections of non-essential canals. The proposed Project is expected to produce a total of 8,271 average annual habitat units (HUs).

I find that the C-111 SC Western Project, located in southern Miami-Dade County, is an integral part of the CERP and I have considered all significant aspects in the overall public interest, including engineering feasibility, environmental, social and economic effects. The C-111 SC Western Project Recommended Plan features include: the Frog Pond Detention Area (approximately 590 acres in size); modification of the existing Aerojet Canal into a detention area; two-225 cfs pump stations (and associated conveyance canals); a new water control structure in the lower C-111; a plug in the L-31E canal; operational changes at S-20; plugs in the C-110 Canal; and experimental changes in the stage control triggers at S-18C. These features are necessary to create the hydraulic ridge between Taylor Slough and the C-111 Canal, which will improve the quantity, timing, and distribution of water delivered to Florida Bay via Taylor Slough. The estimated cost of these features, including PED and construction management, is \$161,868,000. The recommended plan also has recreational components which will help to fill existing and projected SCORP 2000 recreation deficits for Region 11 and public needs heard during the CERP Master Recreation Plan Outreach in 2006 and 2008. The estimated cost of the recreation components is \$256,000. The recommended plan construction cost estimate includes project monitoring costs that will occur during construction. The project monitoring costs to occur during construction are estimated to cost \$7,640,000. The Project monitoring includes hydrometeorological, water quality, and ecological monitoring which will be implemented over the first 5 years of the Project to ensure proper operation and performance of the Project, observe ecological changes in response to plan implementation, and ensure compliance

with necessary water quality monitoring regulatory requirements. The recommended plan includes endangered species monitoring which will occur over the first 10 years of the Project and is required by the USFWS Final Biological Opinion. The recommended plan includes vegetation management and monitoring over the first 10 years of the Project for the purpose of long term control of non-native species and reestablishment of native flora. Lastly, operation and maintenance (O&M) criteria have been established to achieve the goals, purposes, and benefits outlined in the Project Implementation Report (PIR), including the improvement of the quantity, timing, and distribution of water in the natural system. The annual estimated cost of O&M is \$1,493,000. The annual O&M cost includes \$25,000 annually for O&M of the recreation features and \$267,000 annually for the monitoring and vegetation management costs which will occur after construction completion.

Therefore, I recommend that the C-111 SC Western Project as described in the section of this report entitled "The Recommended Plan", with such modifications thereof as in the discretion of the Chief of Engineers, may be advisable, be authorized for construction. The total estimated first cost for the C-111 SC Western Project is \$161,868,000 (FY '11 price levels). Included in the total first cost for the C-111 SC Western Project is the recreation plan totaling \$256,000. The estimated total annual cost of operation, maintenance, repair, replacement, and rehabilitation (OMRR&R) of the ecosystem restoration elements is \$1,468,000 with an estimated Federal OMRR&R cost of \$734,500. The estimated annual cost for the OMRR&R of the recreation elements is \$25,000 which is 100 percent non-Federal.

The above recommendations are made with the provision that the Non-Federal Sponsor and the Secretary of the Army shall enter into a binding agreement defining the terms and conditions of cooperation for implementing the Project, and that the Non-Federal Sponsor agrees to perform the following items of local cooperation:

- a) Provide 50 percent of total project costs consistent with the provisions of Section 601(e) of the WRDA 2000 including authority to perform design and construction of project features consistent with Federal law and regulation.
- b) Provide all lands, easements, and rights-of-way, including suitable borrow and dredged or excavated material disposal areas, and perform or assure the performance of all relocations that the Government and the Non-Federal Sponsor jointly determine to be necessary for the construction, operation, maintenance, repair, replacement and rehabilitation of the Project and valuation will be in accordance with the Master Agreement:

- c) Shall not use the ecosystem restoration features or lands, easements, and rights-of-way required for such features as a wetlands bank or mitigation credit for any other Non-CERP projects.
- d) Give the Government a right to enter, at reasonable times and in a reasonable manner, upon land that the Non-Federal Sponsor owns or controls for access to the Project for the purpose of inspection, and, if necessary, for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the Project.
- e) Assume responsibility for operating, maintaining, repairing, replacing, and rehabilitating (OMRR&R) the Project or completed functional portions of the Project in a manner compatible with the Project's authorized purposes and in accordance with applicable Federal and State laws and specific directions prescribed in the OMRR&R manuals and any subsequent amendments thereto. Cost sharing for OMRR&R of the Project will be in accordance with Section 601 of WRDA 2000:
  - (e) COST SHARING -
    - (4) Operation & Maintenance -Notwithstanding section 528(e)(3) of the WRDA 1996 (110 Stat. 3770), the Non-Federal Sponsor shall be responsible for 50 percent of the cost of operation, maintenance, repair, replacement, and rehabilitation activities authorized under this section....
- f) The Non-Federal Sponsor shall operate, maintain, repair, replace and rehabilitate the recreational features of the Project and is responsible for 100 percent of the costs.
- g) Keep the recreation features, and access roads, parking areas, and other associated public use facilities, open and available to all on equal terms.
- h) Unless otherwise provided for in the statutory authorization for this Project, comply with Section 221 of PL 91-611, Flood Control Act of 1970, as amended, and Section 103 of the WRDA of 1986, PL 99-662, as amended which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until the Non-Federal Sponsor has entered into a written agreement to furnish its required cooperation for the Project or separable element.
- i) Hold and save the Government free from all damages arising from the construction, OMRR&R of the Project and any project-related

betterments, except for damages due to the fault or negligence of the Government or the Government's contractors.

- j) Keep and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the Project to the extent and in such detail as will properly reflect total project costs and comply with the provisions of the CERP Master Agreement between the Department of Army and the South Florida Water Management District for Cooperation in Constructing and Operating, Maintaining, Repairing, Replacing, and Rehabilitating Projects Authorized to be Undertaken Pursuant to the Comprehensive Everglades Restoration Plan, executed on August 13, 2009, including Article XI Maintenance of Records and Audit.
- k) Perform, or cause to be performed, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 USC 9601-9675, that may exist in, on, or under lands, easements or rights-of-way necessary for the construction and operation and maintenance (O&M) of the Project; except that the Non-Federal Sponsor shall not perform such investigations on lands, easements, or rights-of-way that the Government determines to be subject to the navigation servitude without prior specific written direction by the Government.
- l) Assume complete financial responsibility for all necessary cleanup and response costs of any CERCLA regulated materials located in, on or under lands, easements, or right-of-ways that the Government determines necessary for the construction and OMR&R.
- m) As between the Government and the Non-Federal Sponsor, the Non-Federal Sponsor shall be considered the operator of the Project for the purposes of CERCLA liability. To the maximum extent practicable, the Non-Federal Sponsor shall OMR&R the Project in a manner that will not cause liability to arise under CERCLA.
- n) Prevent obstructions of and encroachments on the Project (including prescribing and enforcing regulations to prevent such obstruction or encroachments) which might reduce ecosystem restoration benefits, hinder O&M, or interfere with the Project's proper function, such that as any new developments on Project lands or the addition of facilities which would degrade the benefits of the Project.

- 
- o) Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, PL 91-646, as amended by the title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987 (PL 100-17), and Uniform Regulations contained in 49 CFR part 24, in acquiring lands, easements, and rights-of-way, and performing relocations for construction, O&M of the Project, and inform all affected persons of applicable benefits, policies, and procedures in connection with said act.
  - p) Comply with all applicable Federal and State laws and regulations, including, but not limited to, Section 601 of the Civil Rights Act of 1964, PL 88-352, and Department of Defense Directive 5500.11 issued pursuant thereto, as well as Army Regulation 600-7, entitled, "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army," and all applicable Federal labor standards and requirements including, but not limited to, 40 U.S.C. 3141-3148 and 40 U.S.C. 3701-3708 (revising, codifying and enacting without substantive change the provisions of the Davis-Bacon Act [formerly 40 U.S.C. 276a et seq.], the Contract Work Hours and Safety Standards Act [formerly 40 U.S.C. 327 et seq.] and the Copeland Anti-Kickback Act [formerly 40 U.S.C. 276c]).
  - q) Comply with Section 106 of the National Historic Preservation Act in completion of all consultation with Florida's State Historic Preservation Office and, as necessary, the Advisory Council on Historic Preservation prior to construction as part of the Pre-construction Engineering and Design phase of the Project.
  - r) Provide 50 percent of that portion of total cultural resource preservation mitigation and data recovery costs attributable to the Project that are in excess of one percent of the total amount authorized to be appropriated for the Project.
  - s) Do not use Federal funds to meet the Non-Federal Sponsor's share of total project costs unless the Federal granting agency verifies in writing that the expenditure of such funds is expressly authorized and in accordance with Section 601(e) of WRDA 2000.
  - t) The Non-Federal Sponsor agrees to participate in and comply with applicable Federal floodplain management and flood insurance programs consistent with its statutory authority.
    - 1) Not less than once each year the Non-Federal Sponsor shall inform affected interests of the extent of protection afforded by the Project.

- 2) The Non-Federal Sponsor shall publicize flood plain information in the area concerned and shall provide this information to zoning and other regulatory agencies for their use in preventing unwise future development in the flood plain and in adopting such regulations as may be necessary to prevent unwise future development and to ensure compatibility with protection levels provided by the Project.
- 3) The Non-Federal Sponsor shall comply with Section 402 of WRDA 1986, as amended (33 U.S.C. 701b-12), which requires a non-Federal interest to have prepared, within one year after the date of signing a project partnership agreement for the Project, a floodplain management plan. The plan shall be designed to reduce the impacts of future flood events in the project area, including but not limited to, addressing those measures to be undertaken by non-Federal interests to preserve the level of flood protection provided by the Project. As required by Section 402, as amended, the non-Federal interest shall implement such plan not later than one year after completion of construction of the Project. The Non-Federal Sponsor shall provide an information copy of the plan to the Government upon its preparation.
- 4) The Non-Federal Sponsor shall prescribe and enforce regulations to prevent obstruction of or encroachment on the Project or on the lands, easements, and rights-of-way determined by the Government to be required for the construction, operation, maintenance, repair, replacement, and rehabilitation of the Project, that could reduce the level of protection the Project affords, hinder operation or maintenance of the Project, or interfere with the Project's proper function.
- u) The Non-Federal Sponsor shall execute under State law the reservation or allocation of water for the natural system as identified in the PIR for this authorized CERP Project as required by Sections 601(h)(4)(B)(ii) of WRDA 2000 and the Non-Federal Sponsor shall provide information to the Government regarding such execution. In compliance with 33 CFR 385, the District Engineer will verify such reservation or allocation in writing. Any change to such reservation or allocation of water shall require an amendment to the PPA after the District Engineer verifies in writing in compliance with 33 CFR 385 that the revised reservation or allocation continues to provide for an appropriate quantity, timing, and distribution of water dedicated and managed for the natural system after considering any changed circumstances or new information since completion of the PIR for the authorized CERP Project.

Section 601(e)(5)(B) of the WRDA 2000 authorizes the Secretary of the Army to provide credit to the Non-Federal sponsor for work completed by it during the

period of construction pursuant to a Project Partnership Agreement (PPA) and a determination by the Secretary that the work is integral to the CERP. As part of its initiative for early implementation of certain CERP projects, the Non-Federal sponsor has stated that it will construct the C-111 SC Western Project consistent with this report, in advance of Congressional authorization and the signing of a PPA. Under the authority of Section 6004 of WRDA 2007, the Non-Federal sponsor, on August 13, 2009, executed the required pre-partnership credit agreement (PPCA) to preserve its opportunity for credit for in-kind work completed in advance of execution of a PPA. The Non-Federal sponsor is exploring alternative project delivery methods to expedite implementation of the Project through the State expedited program. Such delivery methods may include public-private partnerships in which the Non-Federal sponsor contracts with a private or not-for-profit entity for services that may include designing, building, operating or financing these components. I believe that it would be in the public interest for this Project to be implemented expeditiously due to the early benefits to the surrounding habitat, as well as hydrologic benefits to Federal lands and estuaries in other portions of the south Florida ecosystem. Therefore, I recommend that should the Non-Federal sponsor construct portions of the C-111 SC Western Project prior to the execution of a PPA for this Project, and does enter into a PPCA, the Non-Federal sponsor be credited for such construction costs at the time the PPA for the C-111 SC Western Project is executed. Such credit would be applied toward the Non-Federal sponsor's share of the costs associated with the implementation of the CERP as authorized by Section 601(e)(5)(C) of WRDA 2000, shall not include cash reimbursements, and shall be subject to: a) the authorization of the C-111 SC Western Project by law; b) a determination by the Secretary of the Army that the construction work completed under the PPCA is integral to the authorized CERP restoration project; c) a certification by the District Engineer that the costs are reasonable, allowable, necessary, auditable, and allocable; and d) a certification by the District Engineer that the activities have been implemented in accordance with USACE design and construction standards and applicable Federal and State laws. The recommendations contained herein reflect the information available at this time and current Departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to the Congress as proposals for authorization and implementation funding. However, prior to transmittal to the Congress, the Sponsor, the State, interested Federal agencies, and other parties will be advised of any modifications and will be afforded an opportunity to comment further.

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Alfred A. Pantano, Jr.  
Colonel, U.S. Army  
District Commander

SECTION 11  
LIST OF PREPARERS

## 11.0 LIST OF PREPARERS

<b>Preparer</b>	<b>Agency</b>	<b>Discipline/Expertise</b>
Jim Baker	USACE	Biologist
Robin Bennett	SFWMD	Ecologist
Donald Beter	USACE	Mechanical Engineer
Gwen Burzycki	DERM	Botanist
Eric Bush	USACE	Plan Formulation
Michael Collis	USACE	Project Manager
Eddie Douglass	USACE	Hydraulic Engineer
Edward Dunlop	USACE	Civil Engineer
Robert Evans	USACE	Hydraulic Engineer
Richard Fike	USFWS	Biologist
Natalie Garrett	USACE	Archaeologist
Cem Goral	USACE	Office of Counsel
Jorge Jaramillo	SFWMD	Design Phase Project Manager
Stephen Kelly	SFWMD	Ecologist
Vinh Le	USACE	Electrical Engineer
Tracey Leeser	USACE	Cost Engineer
Andrew Loschiavo	USACE	Biologist
Ed Kearns	ENP	Oceanographer
Shawn Komlos	USACE	Physical Scientist
Jerry Krenz	SFWMD	CERP Recreation Program Manager
Christopher Madden	SFWMD	Ecologist
Amanda McDonald	SFWMD	Ecologist
Brenda Mills	SFWMD	Lead Planner
Steve Myers	USACE	Geology
Don Nelson	USACE	Office of Counsel/Real Estate
Karl Nixon	USACE	Real Estate
John Pax	USACE	Office of Counsel
William Perry	ENP	Ecologist
Randy Rabb	USACE	Geotechnical Engineer
Mark Shafer	USACE	Environmental Engineer
Stephanie Raulerson	USACE	Hydraulic Engineer
Pete Rawlik	SFWMD	Ecologist
Amy Renshaw	ENP	Physical Scientist
Sal Resurreccion	USACE	Environmental Engineer
Dave Rudnick	SFWMD	Ecologist

Anya Savage	USACE	Biologist
Ray Sciortino	SFWMD	Design Phase Assistant Project Manager
John Shaffer	SFWMD	Project Management – Planning and Design
Aaron Stormant	USACE	Planning Technical Lead
Paul Stevenson	USACE	Biologist/Landscape Architect
Brad Tarr	USACE	Biologist/NEPA Coordinator
Larry Taylor	USACE	Biologist/Operations
Ray Wimbrough	USACE	Biologist/Planning Technical Lead
Kevin Wittmann	USACE	Economist/Planner
Dewey Worth	SFWMD	Project Management – Planning and Design
Frank Zepka	USACE	Environmental Engineer
Autumn Ziegler	USACE	Electrical Engineer
Tracy Ziegler	ENP	Marine Biologist

Key: DERM Miami-Dade County Department of Environmental  
Resources Management  
USFWS U.S. Fish and Wildlife Service  
ENP Everglades National Park  
SFWMD South Florida Water Management District  
USACE U.S. Army Corps of Engineers

**SECTION 12  
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**12.0 INDEX****A**

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## 13.0 GLOSSARY OF TERMS

**A**

**Acres:** Area of land equal to 43,560 square feet. In the International System of Units (S.I.) metric system, one acre is equal to 4,046.9 square meters or 2.471 hectares.

**Acres-foot:** The quantity of water required to cover one acre to a depth of 1 foot. Equal to 43,560 cubic feet (1,233.5 cubic meters).

**Action Plan:** A plan that describes what needs to be done and when it needs to be completed.

**Activity:** A specific project task that requires resources and time to complete.

**Adaptive Assessment:** A process for learning and incorporating new information into the planning and evaluation phases of the restoration program. This process ensures that the scientific information produced for this effort is converted into products that are continuously used in management decision-making.

**Adverse Impact:** The detrimental effect of an environmental change relative to desired or baseline conditions.

**Affected Environment:** Existing biological, physical, social, and economic conditions of an area subject to change, both directly and indirectly, as a result of a proposed human action.

**Air Quality:** Measure of the health-related and visual characteristics of the air, often derived from quantitative measurements of the concentrations of specific injurious or contaminating substances.

**Aquatic:** Consisting of, relating to or being in water; living or growing in, on or near the water; or taking place in or on the water.

**Aquifer:** An underground geologic formation, a bed or layer of earth, gravel or porous stone, that yields water or in which water can be stored.

**Authorization:** An act by the Congress of the United States, which authorizes use of public funds to carry out a prescribed action.

## B

**Baseline:** The initial approved plan for schedule, cost or performance management, plus or minus approved changes, to which deviations will be compared as the project proceeds.

**Best Management Practices [BMPs]:** The best available land, industrial and waste management techniques or processes that reduce pollutant loading from land use or industry, or which optimize water use.

**Borrow Canal:** Canal or ditches where excavated material is used for earthen construction nearby. Also, typically denotes a canal with no conveyance or water routing purpose.

## C

**Canal:** A human-made waterway that is used for draining or irrigating land or for navigation by boat.

**Candidate Species:** Plant or animal species not yet officially listed as threatened or endangered, but which is undergoing status review by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service.

**Central and Southern Florida Project [C&SF]:** A multi-purpose project, first authorized by Congress in 1948, which provides flood control, water supply protection, water quality protection and natural resource protection.

**Channel:** Natural or artificial watercourse, with a definite bed and banks to confine and conduct continuously or periodically flowing water.

**Coastal Ridge:** Area of land bordering the coast whose topography is elevated higher than land further inland.

**Comprehensive Everglades Restoration Plan [CERP]:** The plan for the restoration of the greater Everglades and to meet water supply and flood protection needs in the urban and agricultural regions of south Florida.

**Comprehensive Plan:** See Comprehensive Everglades Restoration Plan.

**Control Structure:** A human-created structure that regulates the flow of waters or the level of waters.

**Conveyance Capacity:** The rate at which water can be transported by a canal, aqueduct, or ditch. In this document, conveyance capacity is generally measured in cubic feet per second (cfs).

**Cost-Benefit Analysis:** An analysis, often stated as a ratio, used to evaluate a proposed course of action.

**Critical Habitat:** A description, which may be contained in a Biological Opinion, of the specific areas with physical or biological features essential to the conservation of a listed species and which may require special management considerations or protection; these areas have been legally designated via Federal Register notices.

**Cubic feet per second [cfs]:** A measure of the volume rate of water movement. As a rate of stream-flow, a cubic foot of water passing a reference section in one second of time. One cubic foot per second equals 0.0283 meter /second (7.48 gallons per minute). One cubic foot per second flowing for 24 hours produces approximately 2 acre-feet.

**Culvert:** A concrete, metal or plastic pipe that transports water.

## D

**Discharge:** The rate of water movement as volume per unit time, usually expressed as cubic feet per second.

**Dissolved Oxygen [D.O.]:** The concentration of oxygen dissolved in water, sometimes expressed as percent saturation, where saturation is the maximum amount of oxygen that theoretically can be dissolved in water at a given altitude and temperature.

**Dry Season:** Hydrologically, for south Florida, the months associated with a lower incident of rainfall, November through May.

**Duration:** The period of time over which a task occurs, in contrast to effort, which is the amount of labor hours a task requires; duration establishes the schedule for a project, and effort establishes the labor costs.

## E

**Ecology:** The science of the relationships between organisms and their environments, also called bionomics; or the relationship between organisms and their environment.

**Ecosystem:** A functional group of animal and plant species that operate in a unique setting that is mostly self-contained.

**Effectiveness:** A measure of the quality of attainment in meeting objectives; this is distinguished from efficiency, which is measured by the volume of output achieved for the input used.

**Endangered Species:** Any species or sub-species of bird, mammal, fish, amphibian, reptile, or plant which is in serious danger of becoming extinct throughout all, or a significant portion of its range. Federally endangered species are officially designated by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service and published in the Federal Register.

**Enhancement:** Measures which develop or improve the quality or quantity of existing conditions or resources beyond a condition or level that would have occurred without an action; i.e., beyond compensation.

**Environmental and Economic Equity [EEE]:** A program-level activity, referred to in early phases of the program as Socioeconomic and Environmental Justice.

**Environmental Consequences:** The impacts to the Affected Environment that are expected from implementation of a given alternative.

**Environmental Impact Statement (EIS):** An analysis required by the National Environmental Policy Act for all major federal actions, which evaluates the environmental risks of alternative actions.

**Evaluate:** To appraise or determine the value of information, options or resources being provided to a project.

**Exotic species:** Introduced species not native to the place where they are found.

## F

**Fallowed Land:** Cultivated land that lies idle during a growing season.

**Feasibility Study:** The second phase of a project. The purpose is to describe and evaluate alternative plans and fully describe recommended project.

**Federally Endangered Species:** An endangered species which is officially designated by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service and published in the Federal Register.

**Flood Control Storage Capacity:** Reservoir capacity reserved for the purpose of regulating flood inflows to reduce flood damage downstream [compare with reservoir storage capacity].

**Flow:** The volume of water passing a given point per unit of time.

**Instream Flow Requirements:** Amount of water flowing through a stream course needed to sustain in-stream values.

**Minimum Flow:** Lowest flow in a specified period of time.

**Peak Flow:** Maximum instantaneous flow in a specified period of time.

## G

**Geospatial Data:** Information, which includes, but is not limited to surveys, maps, aerial photography, aerial imagery, and biological, ecological and hydrological modeling coverages.

**Goal:** Something to be achieved. Goals can be established for outcomes (results) or outputs (efforts).

**Groundwater:** Water stored underground in pore spaces between rocks and in other alluvial materials and in fractures of hard rock occurring in the saturated zone.

**Groundwater Level:** Refers to the water level in a well, and is defined as a measure of the hydraulic head in the aquifer system.

**Groundwater Pumping:** Quantity of water extracted from groundwater storage.

**Groundwater Seepage:** Groundwater flow in response to a hydraulic gradient.

**Groundwater Table:** The upper surface of the zone of saturation, except where the surface is formed by an impermeable body.

## H

**Habitat:** Area where a plant or animal lives.

**Hammock:** Localized, thick stands of trees that can grow on natural rises of only a few inches in the land.

**Hectare:** A unit of measure in the metric system equal to 10,000 square meters or 2.47 acres.

**Hydraulic Gradient:** Denotes slope of watercourse, above or below ground water level. Typically, defines energy loss or consumption in the conveyance process.

**Hydraulic Head (Lift):** Denotes relative comparison of water stages for gravity flow. Pump stations generally provide lift or increase water level elevations.

**Hydrologic Condition:** The state of an area pertaining to the amount and form of water present. For example, saturated ground (water table at surface), lake stage and river flow rate.

**Hydrologic Response:** An observed decrease or increase of water in a particular area.

**Hydrology:** The scientific study of the properties, distribution and effects of water on the earth's surface, in the soil and underlying rocks, and in the atmosphere.

**Hydropattern:** Refers to depth as well as hydroperiod is hydropattern. Hydropatterns are best understood by a graphic depiction of water level (above as well as below the ground) through annual cycles.

**Hydroperiod:** For non-tidal wetlands, the average annual duration of flooding is called the hydroperiod, which is based only on the presence of surface water and not its depth.

## I

**Impoundment:** An above ground reservoir used to store water.

**Independent Technical Review Team:** A group autonomous of the project team established to conduct reviews to ensure that design products are consistent with established criteria, guidance, procedures and policies.

**Indicator Species:** Organism, species, or community which indicates presence of certain environmental conditions.

**Invertebrate:** A small animal that does not have a backbone, examples include crayfish, insects and mollusks, which can be indicators of ecosystem status.

**J****K****L**

**Lag:** The amount of time after one task is started or completed before the next task can be started or completed.

**Land Classification:** An economic classification of variations in land reflecting its ability to sustain long-term agricultural production.

**Levee:** A human-created embankment that controls or confines water.

**Littoral Zone:** The shore of land surrounding a water body that is characterized by periodic inundation or partial saturation by water level. Typically defined by species of vegetation found.

**Local Sponsor:** The South Florida Water Management District.

**M**

**Macrophytes:** Visible plants found in aquatic environments, including sawgrass, sedges and lilies.

**Marsh:** An area of low-lying wetland.

**Master Program Management Plan [MPMP]:** A document which describes the framework and processes to be used by the USACE and the SFWMD for managing and monitoring implementation of the Comprehensive Everglades Restoration Plan.

**MIKE SHE:** An integrated surface water/ground water model, which includes a module for estimating supplemental irrigation requirements based upon land use, soil type, crop type, rainfall, and evapotranspiration.

**Mitigation:** To make less severe; to alleviate, diminish or lessen; one or all of the following may comprise mitigation: (1) avoiding an impact altogether by not taking a certain action or parts of an action; (2) minimizing impacts by limiting the degree or magnitude of an action and its implementation; (3) rectifying an impact by repairing, rehabilitating or restoring the affected environment; (4) reducing or eliminating an impact over time by preservation and

maintenance operations during the life of an action; and (5) compensating for an impact by replacing or providing substitute resources or environments.

**Model:** A tool used to mathematically represent a process which could be based upon empirical or mathematical functions. Models can be computer programs, spreadsheets, or statistical analyses.

**Monitoring:** The capture, analysis and reporting of project performance, usually as compared to plan.

**Muck lands:** Fertile soil containing putrid vegetative matter.

## N

**National Economic Development (NED):** USACE benefit evaluation process used to justify recreation expenditures.

## O

**Objective:** A goal expressed in specific, directly measurable terms.

**Off-peak:** Less than peak design flow rate during storm runoff producing events.

**Operation, Maintenance, Repair, Replacement and Rehabilitation (OMRR&R):** 100 percent local sponsor responsibility for OMRR&R recreation facilities and amenities.

**Other Program Element [OPE]:** One of twelve components identified in the Comprehensive Plan which will be implemented through programs other than CERP, including the Critical Restoration Projects Authority, or which will be implemented with an appropriate local sponsor under separate Design Agreements and Project Management Plans.

**Outreach:** Proactive communication and productive involvement with the public to best meet the water resource needs of south Florida.

**Oxygen Demand:** The biological or chemical demand of dissolved oxygen in water. Required by biological processes for respiration.

## P

**Performance Measure:** A desired result stated in quantifiable terms to allow for an assessment of how well the desired result has been achieved.

**Periphyton:** The biological community of microscopic plants and animals attached to surfaces in aquatic environments, for example algae.

**Phosphorus [P]:** Element or nutrient required for energy production in living organisms. Distributed into the environment mostly as phosphates by agricultural runoff (fertilizer) and life cycles. Frequently the limiting factor for growth of microbes and plants.

**Program:** A group of related projects managed in a coordinated manner; programs usually include an element of on-going activity.

**Program Management:** A structure and set of strategies to be used during the implementation phase, which build upon the interagency partnership, implementation guidelines and successful strategies developed during the Restudy's feasibility planning phase.

**Programmatic Environmental Impact Statement [PEIS]:** An environmental impact statement prepared prior to a federal agency's decision regarding a major program, plan or policy, which usually is broad in scope and followed by subsequently more narrowly focused National Environmental Policy Act compliance documents.

**Programmatic Regulations:** Section 601(h) of WRDA 2000 states that the overarching purpose of the Comprehensive Plan is the restoration, preservation and protection of the south Florida ecosystem while providing for the other water related needs of the region, including water supply and flood protection. The purpose of the regulations is to ensure that the goals and objectives of CERP are achieved. The regulations will contain: (1) processes for the development of Project Implementation Reports, Project Cooperation Agreements and operating manuals that ensure the goals and objectives of the plan are achieved; (2) processes that ensure new scientific, technical, or other information such as that developed through adaptive management is integrated into the implementation of the plan; and (3) processes to establish interim goals to provide a means by which the restoration success of the plan may be evaluated throughout the implementation process.

**Project:** A sequence of tasks with a beginning and an end that uses time and resources to produce specific results. Each project has a specific, desired

outcome, a deadline or target completion date and a budget that limits the amount of resources that can be used to complete the project.

**Project Cooperation Agreement [PCA]:** A document that describes the roles and responsibilities of the USACE and SFWMD for real estate acquisition, construction, construction management and operations and maintenance.

**Project Team:** An interdisciplinary group formed from the resources of the implementing agencies, which develops the products necessary to deliver the project.

**Project Duration:** The time it takes to complete an entire project from starting the first task to finishing the last task.

**Project Implementation Report [PIR]:** A decision document that will bridge the gap between the conceptual design contained in the Comprehensive Plan and the detailed design necessary to proceed to construction.

**Project Management:** A discipline of combining systems, techniques and people to complete a project within established goals of time, budget and quality.

**Project Management Information System:** A system used to chart activities and data and to track progress and information flow in a project.

**Project Management Plan [PMP]:** A document which establishes the project's scope, schedule, costs, funding requirements and technical performance requirements, including the various functional area's performance and quality criteria that will be used to produce and deliver the products that comprise the project.

**Project Manager:** A person who takes overall responsibility for coordinating a project to ensure the desired result comes in on time and within budget.

**Project Phase:** A collection of logically related project activities, usually culminating in the completion of a major deliverable.

**Proposed Action:** Plan that a federal agency intends to implement or undertake and which is the subject of an environmental analysis. Usually, but not always, the proposed action is the agency's preferred alternative for a project. The proposed action and all reasonable alternatives are evaluated against the no action alternative.

**Public Involvement:** Process of obtaining citizen input into each stage of the development of planning documents. Required as a major input into any EIS.

**Public Outreach:** A program-level activity with the objectives of keeping the public informed of the status of the overall program and key issues associated with restoration implementation and providing effective mechanisms for public participation in the restoration plan development.

**Pump Station:** A human constructed structure that uses pumps to transfer water from one location to another.

## Q

**Quality Assurance [QA]:** The process of evaluating overall project performance on a regular basis to provide confidence that the project will satisfy the relevant quality standards.

**Quality Control [QC]:** The process of monitoring specific project results to determine if they comply with relevant quality standards, and identifying means of eliminating causes of unsatisfactory performance.

## R

**Recharge:** The processes of water filling the voids in an aquifer, which causes the piezometric head or water table to rise in elevation.

**Reconnaissance Study:** The first phase of a project. It has four phases (1) to define problem, (2) assess sponsor's level of interest and support, (3) decide to progress to feasibility phase based on federal interest, (4) estimate time and money to complete feasibility study.

**Record of Decision:** Concise, public, legal document which identifies and publicly and officially discloses the responsible official's decision on the alternative selected for implementation. It is prepared following completion of an Environmental Impact Statement.

**Regional Water Supply Plan:** Detailed water supply plan developed by the District under Ch. 373.0361, F.S.

**Reservoir:** Artificially impounded body of water.

**Reservoir Storage Capacity:** Reservoir capacity normally usable for storage and regulation of reservoir inflows to meet established reservoir operating requirements.

**Flood Control Storage Capacity:** Reservoir capacity reserved for the purpose of regulating flood inflows to reduce flood damage downstream.

**Restoration:** The recovery of a natural system's vitality and biological and hydrological integrity to the extent that the health and ecological functions are self-sustaining over time.

**Restoration Coordination and Verification [RECOVER]:** A program-level activity whose role is to organize and apply scientific and technical information in ways that are most effective in supporting the objectives of the Comprehensive Everglades Restoration Plan.

**Restudy:** The Central and South Florida Project Comprehensive Review Study, authorized by the Water Resources Development Act of 1992, which examined the Central and Southern Project to determine the feasibility of modifying the project to restore the south Florida ecosystem and provide for other water-related needs of the region, and which resulted in The Final Integrated Feasibility Report and Programmatic Environmental Impact Statement, which was transmitted to Congress on July 1, 1999.

**Risk Analysis:** An evaluation of the feasibility or probability that the outcome of a project or policy will be the desired one; usually conducted to compare alternative scenarios, action plans or policies.

## S

**Scoping:** The process of defining the scope of a study, primarily with respect to the issues, geographic area, and alternatives to be considered. The term is typically used in association with environmental documents prepared under the National Environmental Policy Act.

**Scrub:** A community dominated by pinewoods with a thick understory of oaks and saw palmetto, and which occupies well-drained, nutrient-poor sandy soils.

**Seepage:** Water that escapes control through levees, canals or other holding or conveyance systems.

**Sheet Flow:** Water movement as a broad front with shallow, uniform depth.

**Slough:** A depression associated with swamps and marshlands as part of a bayou, inlet or backwater; contains areas of slightly deeper water and a slow current; can be thought of as the broad, shallow rivers of the Everglades.

**South Florida Ecosystem:** An area consisting of the lands and waters within the boundary of the South Florida Water Management District, including the Everglades, the Florida Keys and the contiguous near-shore coastal waters of South Florida.

**South Florida Water Management Model (SFWMM):** An integrated surface water groundwater model that simulates the hydrology and associated water management schemes in the majority of south Florida using climatic data from January 1, 1965, through December 31, 1995. The model simulates the major components of the hydrologic cycle and the current and numerous proposed water management control structures and associated operating rules. It also simulates current and proposed water shortage policies for the different sub-regions in the system.

**Spatial Extent:** Area that is continuous without non-integrating internal barriers or land usage.

**Spillway:** Overflow structure of a dam.

**Stakeholders:** People or organizations having a personal or enterprise interest in the results of a project, who may or may not be involved in completing the actual work on that project.

**Stormwater:** Surface water resulting from rainfall that does not percolate into the ground or evaporate.

**Success Indicator:** A subset of performance measures selected as a good representation of overall performance.

**Surficial Aquifer:** An aquifer that is closest to the surface and is unconfined; the water level of a surficial aquifer is typically associated with the groundwater table of an area.

**Sustainability:** The state of having met the needs of the present without endangering the ability of future generations to be able to meet their own needs.

**Swamp:** A generally wet, wooded area where standing water occurs for at least part of the year.

## T

**Threatened Species:** Legal status afforded to plant or animals species that are likely to become endangered within the foreseeable future throughout all or a significant portion of their range, as determined by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service.

**Tiering:** Procedure which allows an agency to avoid duplication of paperwork through incorporation by reference of the general discussions and relevant

specific discussions from an Environmental Impact Statement (EIS) of broader scope into a subsequent EIS of narrower scope.

**Trade-Off:** Allowing one aspect of a project to change, usually for the worse, in return for another aspect of the project getting better.

**Tributary:** A stream feeding into a larger stream, canal or water-body.

## U

## V

## W

**Water Budget:** An account of all water inflows, outflows and change in storage for a pre-specified period of time.

**Water Conservation Areas [WCAs]:** Marshland areas that were designed for use as storage to prevent flooding, to irrigate agriculture and recharge well fields and as input for agricultural and urban runoff; the Water Conservation Areas WCA-1, WCA-2A, WCA-2B, WCA-3A and WCA-3B comprise five surface water management basins in the Everglades; bounded by the Everglades Agricultural Area on the north and the Everglades National Park basin on the south, the WCAs are confined by levees and water control structures that regulate the inflows and outflows to each one of them.

**Watershed:** A region or area bounded peripherally by a water parting and draining ultimately to a particular watercourse or body of water.

**Wetlands:** Areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction.

**Wet Season:** Hydrologically, for south Florida, the months associated with a higher than average incident of rainfall, June through October.

**Wildlife Corridor:** A relatively wide pathway used by animals to transverse from one habitat arena to another.

**Wildlife Habitat:** An area that provides a water supply and vegetative habitat for wildlife.

**X****Y****Yellow Book:** See "Restudy"**Z**

SECTION 14  
ACRONYM LIST

## 14.0 ACRONYMS

**A**

8.5 SMA	8.5 Square Mile Area
AFB	Alternatives Formulation Briefing
AM	Adaptive Management
ATR	Agency Technical Review
ATV	all-terrain vehicles

**B**

BBCW	Biscayne Bay Coastal Wetlands
BDRA	Bird Drive Recharge Area
BEBR	Florida Bureau of Economic and Business Research
bls	below land surface
BMP	Best Management Practices
BNP	Biscayne National Park
BO	Biological Opinion

**C**

C-111 SC	C-111 Spreader Canal
C&SF	Central and Southern Florida
CAA	Clean Air Act
CAR	Coordination Act Report
CARL	Conservation and Recreational Lands
CEM	Conceptual Ecological Model
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERP	Comprehensive Everglades Restoration Plan
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	cubic feet per second
CISRERP	Committee for Independent Scientific Review of Everglades Restoration Progress
COP	Combined Operational Plan
COPEC	contaminants of potential environmental concern
CSOP	Combined Structural and Operational Plan
CSSS	Cape Sable Seaside Sparrow
CWA	Clean Water Act

**D**

DERM	Miami-Dade County Department of Environmental Resources Management
DO	Dissolved Oxygen
DOI	Department of the Interior

**E**

EA	Environmental Assessment
ECB	Existing Condition Base
EDR	Engineering Design Report
EEL	Environmentally Endangered Lands
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EMB	Everglades Mitigation Bank
ENP	Everglades National Park
E.O.	Executive Order
EPA	U.S. Environmental Protection Agency
ER	Engineering Regulation
ERRA	Everglades Restoration Resource Area
ESA	Endangered Species Act
ET	Evapotranspiration

**F**

F.A.C	Florida Administrative Code
FB&FK	Florida Bay and Florida Keys
FDOT	Florida Department of Transportation
FDEP	Florida Department of Environmental Protection
FEIS	Final Environmental Impact Statement
FIFRA	Federal Insecticide, Fungicide and Rodenticide Act
FIU	Florida International University
FPDB	Frog Pond Detention Basin
FPIB	Frog Pond Infiltration Basin
FP&L	Florida Power and Light
F.S.	Florida Statute
FWC	Florida Fish and Wildlife Commission
FWCA	Fish and Wildlife Coordination Act
FWO	Future Without
FWOP	Future Without Project
FWS	U.S. Fish and Wildlife Service

**G**

GDM	General Design Memorandum
GM	Guidance Memorandum

GOMFMC Gulf of Mexico Fishery Management Council  
 GRR General Re-evaluation Report

**H**

Hg Mercury  
 HQ Headquarters  
 HSI Habitat Suitability Index  
 HTRW Hazardous, Toxic and Radioactive Waste

**I**

IAR Incremental Adaptive Restoration  
 IOP Interim Operational Plan  
 IOR Initial Operating Regime  
 IPR In-Progress Review  
 ISOP Interim Structural and Operational Plan  
 ITR Independent Technical Review

**J****K****L**

LECSA Lower East Coast Service Area  
 LERR Lands, Easements, Rights of Way, and Relocations  
 LNWR Loxahatchee National Wildlife Refuge  
 LORS Lake Okeechobee Regulation Schedule  
 LRR Limited Re-evaluation Report

**M**

M&I Municipal and Industrial  
 MAP Monitoring and Assessment Plan  
 MCACES Micro-computer Aided Cost Engineering System  
 MDWASD Miami-Dade County Water and Sewer Department  
 MeHg Bioaccumulative Methylmercury  
 MFR Memorandum for Record  
 mgd million gallons per day  
 mg/L milligrams per liter  
 MIS 1.0 Master Implementation Schedule  
 MPRSA Marine Protection, Research and Sanctuaries Act of 1972  
 MSL Mean Sea Level  
 MWD Modified Water Deliveries

**N**

NAI	Next Added Increment
NED	National Economic Development
NEPA	National Environmental Policy Act
NER	National Ecosystem Restoration
NESRS	Northeast Shark River Slough
NGO	Non-government Organization
NGVD	National Geodetic Vertical Datum
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NPS	National Park Service
NRC	National Research Council
NRCS	Natural Resource Conservation Service

**O**

O&M	Operation and Maintenance
OMP	Operational and Monitoring Plan
OMRR&R	Operation, Maintenance, Repair, Replacement and Rehabilitation

**P**

P&G	Principles and Guidelines
PAL	Planning Aid Letter
PCA	Project Cooperation Agreement
PDT	Project Delivery Team
PEC	Probable Effects Concentrations
PED	pre-construction engineering and design
PEIS	Programmatic Environmental Impact Statement
PIR	Project Implementation Report
PL	Public Law
PMP	Project Management Plan
ppb	parts per billion
PSD	Prevention of Significant Deterioration

**Q**

QRB	Quality Review Board
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**R**

RAP	RECOVER Assistance to Projects
RCRA	Resource Conservation and Recovery Act
RGRR	Revised General Re-evaluation Report

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RECOVER	Restoration, Coordination and Verification
Restudy	Central and Southern Florida Project Comprehensive Review Study
ROD	Record of Decision
RPA	Reasonable and Prudent Alternative

**S**

SAD	South Atlantic Division
SAFMC	South Atlantic Fishery Management Council
SCORP	Statewide Comprehensive Outdoor Recreation Plan
SDCS	South Dade Conveyance System
SDW	South Dade Wetlands
SDWMA	South Dade Wetlands Management Area
SFWMD	South Florida Water Management District
SFWMM	South Florida Water Management Model
SGWEA	Southern Glades Wildlife and Environmental Area
SHPO	State Historic Preservation Office
SLERA	Screening Level Ecological Risk Assessment
SLR	Sea Level Rise
SOR	Save Our Rivers
SQAG	Sediment Quality Assessment Guidelines
SR	State Road
STA	Stormwater Treatment Area
SW	Southwest

**T**

TBD	To Be Determined
TEC	Threshold Effects Concentrations
TP	total phosphorus
TSP	Tentatively Selected Plan

**U**

UDB	Urban Development Boundary
UEA	Urban Expansion Area
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey

**V****W**

WCA	Water Conservation Area
WPA	Water Preserve Area

WQ	Water Quality
WQC	Water Quality Certification
WRDA	Water Resources Development Act
WSE	Water Supply Environment

**X**

**Y**

**Z**

SECTION 15  
REFERENCES

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### **15.1 Project Map Metadata**

All maps appearing in this document meet the standards and guidelines as defined in the CERP GIS Standard Operating Procedures (SOP) Manual. These maps are NOT to be used as Stand Alone Documents. To utilize a map as a standalone hand out, please contact the map creator for additional map elements.

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**FOR CONTINUATION OF HOUSE DOCUMENT 112-132**

**CENTRAL AND SOUTHERN FLORIDA PROJECT:  
COMPREHENSIVE EVERGLADES RESTORATION PLAN C-111  
SPREADER CANAL WESTERN PROJECT**

**SEE VOLUME 2**